CALIBRATION MANUAL

HP 8340B
HP 8341B
SYNTHESIZED SWEEPERS

HEWLETT PACKARD

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Section IV: Performance Tests

INTRODUCTION

The procedures in this section test the HP 8340B and HP 8341B's electrical performance using the specifications given in Section I as the performance standards. These tests are intended for use in incoming inspection, calibration verification, and post-repair performance verification. All tests can be performed without access to the interior of the instrument. An HP-IB Operation Verification procedure is also provided at the end of this section to verify proper HP-IB operation of the instrument.

RECOMMENDED TEST EQUIPMENT

Table 4-2 is a complete list of all required equipment for the tests and adjustments supplied in Section IV, Performance Tests, and Section V, Adjustments. Test equipment other than that noted in the table may be substituted if it meets or exceeds the critical specifications indicated in the table.

TEST RECORD

Results of the Performance Test procedures may be tabulated on the test record card located at the end of this section. Each test lists all of the tested specifications and their acceptable limits. The results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after repairs or adjustments have been made.

CALIBRATION CYCLE

This instrument requires periodic verification of performance. The instrument should be checked using the following performance tests at least once every year.

NOTE

The acronym "DUT" (Device Under Test) is used to describe the HP 8340B or 8341B (HP 8340B/41B) under test. The acronym "LO" is used to describe the Local Oscillator.

Options 001, 005, 006, and 007 apply only to HP 8340B's.

Table 4-1. List of Manual Performance Tests[1]

Test Number	Performance Test Title	Page
4-1	Internal Time Base Aging Rate	4-9
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4-3	Sweep Time Accuracy	4-19
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4-15	Amplitude Modulation Test	4-71
4-16	FM Accuracy and Flatness	4-75
4-17[2]	HP-IB Operation Verification Test	4-83

1. This test is not applicable to instruments equipped with Option 006, Delete Pulse Modulation.
2. This is not a Performance Test. It is included as an additional aid to determine that the HP-IB circuitry is operating properly.

Table 4-2. Recommended Test Equipment (1 of 5)

Instrument	Critical Specifications	Recommended Model	Use[1]
Signature Multimeter	Clock Frequency: ≥20 MHz	HP 5005A	T
Oscilloscope	Dual Channel Bandwidth: dc to 100 MHz Vertical Sensitivity: ≤5 mV/Div Horizontal Sensitivity: 50 ns/Div 10 Magnifier External Sweep Capability 50 Ohm Vertical Input	HP 1741A	P, A, T
Oscilloscope Probe	10:1 Divider Probe	HP 10004D	T, A
Digital Voltmeter (DVM)	Range: −50 to +50 Vdc Accuracy: ±0.01% Input Impedance: ≥10 MOhms	HP 3455A or HP 3456A	P, A, T
Power Meter	Power Range: 1μW to 100 mW Accuracy: ±0.02 dB	HP 436A Option 022	P, A, T
Power Sensors	Frequency Range: 10 to 50 MHz Power Range: 1 μW to 100mW	HP 8481A	P, A, T
	Frequency Range: 50 MHz to maximum Frequency of DUT Power Range: 1μW to 100 mW	HP 8485A	P, A, T
Frequency Counter	Frequency Range: Same as DUT Input Impedance: 50 Ohms Frequency Accuracy: time Base Accuracy ± 1 count	HP 5343A Option 011	P, A, T
Universal Counter	Time Interval Range: 100 ns to 200 s	HP 5316A	P, A, T
Spectrum Analyzers	Frequency Range: HP 8340B DUT: 0.01 to 22 GHz HP 8341B DUT: 0.01 to 20 GHz Must have External Time Base Input Center Frequency Accuracy in 0 Hz Span: Same as Time Base Accuracy Minimum Resolution Bandwidth: ≤300 Hz Residual FM: <100 Hz Log Fidelity: ≤1 dB Must have Video Output	HP 8566A or HP 8566B	P, A, T
	Frequency Range: 20 Hz to 40 MHz Resolution Bandwidth: ≤3 Hz	HP 3585A	P, T
Frequency Standard	Frequency: 10 MHz Stability: $>1 \times 10^{-10}$/yr	HP 5061A	P, A
Synthesized Sweeper (used as Local Oscillator in P[1] and A[1], and Sweep Generator in A[1])	Frequency Range: Same as DUT Must have External Time Base Input Frequency Accuracy: Same as Time Base Accuracy RF Power Output: ≥ +4 dBm[3] Phase Noise: Must meet or exceed HP 8340B/41B Line Related Spurious Signals: Must meet or exceed HP 8340B/41B	HP 8340A Opt. 001	P, A

Table 4-2. Recommended Test Equipment (2 of 5)

Instrument	Critical Specifications	Recommended Model	Use[1]
Signal Generator	Frequency: 300 to 400 MHz RF Output Power: ≥0 dBm Settability: to within ±50 kHz	HP 8654A (or HP 8340B/41B)	A
Desktop Computer	HP 236, 226, and 216 are equivalent to the HP 9836, 9826, and 9816 respectively. Of the three, the HP 236 (9836) is suggested. HP 85F includes HP 83936A ROM Drawer, HP 82937A HP-IB Interface, and I/O ROM HP Part No. 00085-15003.	HP 236 HP 226 HP 216 HP 85F	HP-IB
Plotter/Printer ROM	For HP 85F, no substitute.	HP Part No. 00085-10052	HP-IB
Modulation Analyzer	No Substitute	HP 8901A or HP 8902A	P
Pulse Generator	Pulse Width: ≤100 nS Rise Time: ≤10 ns Frequency: 20 Hz to 50 kHz	HP 8012B	P, A, T
Function Generator	Sinewave Amplitude: ≥1 Vrms Sinewave Frequency: dc to 5 MHz	HP 3325A	P, A, T
Amplifier	Frequency Range: 100 kHz to 1.3 GHz Gain: >20 dB	HP 8447F	P
	Frequency Range: 2 to 20 GHz Gain: 15 dB	HP 8349B	P
Power Supply	0 to 50 Vdc Voltage Drift (in 1 hour): ≤ 0.1% +2.5 mV	HP 6294A	P, A
Mixer	Frequency Range: 1 GHz to maximum frequency of DUT	HP Part Number 0955-0307	P, A
Feedthrough Termination	50 Ohm feedthrough	HP 10100C	P
Attenuators	Frequency Range: same as DUT Maximum Input Power: > +20 dBm Attenuation: 10 dB Connectors: APC-3.5[4]	HP 8493C Opt. 010	P, A
	Frequency Range: same as DUT Maximum Input Power: > +20 dBm Attenuation: 20 dB Connectors: APC-3.5	HP 8493C Opt. 020	P, A
Step Attenuator	Frequency Range: DC to 100 MHz Maximum Input Power: ≥200 mW avg. Attenuation 0 to 70 dB, settable in 10 dB steps	HP 355D	P
Power Splitter	Frequency Range: 10 MHz to 26.5 GHz Maximum input power: ≥+20 dBm Input SWR: ≤1.3 Output SWR: ≤1.22 Output tracking: ≤0.25 dB	HP 11667B	P

4. Any precision 3.5 mm adapter may be used in lieu of APC 3.5. This is true for any APC 3.5 equipped product mentioned in this manual.

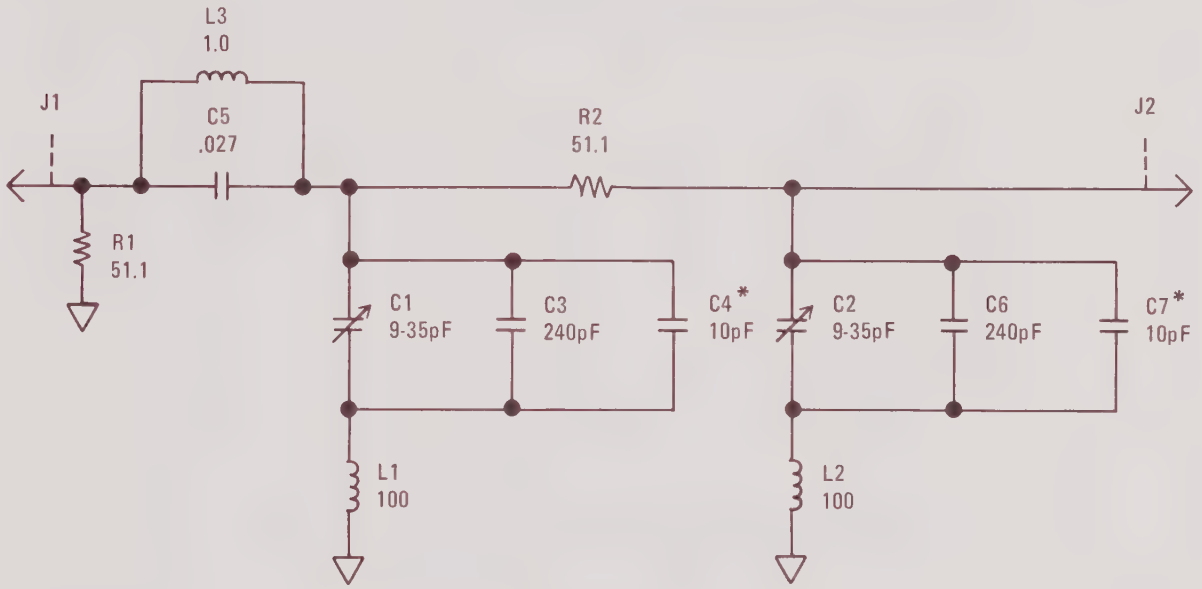
Table 4-2. Recommended Test Equipment (3 of 5)

Instrument	Critical Specifications	Recommended Model	Use[1]
Directional Coupler	Frequency Range: 1.7 to 26.5 GHz Coupling: 16 dB Maximum Input Power: 100mW	HP Part No. 0955-0125	A
Adapters	APC-3.5 (f) to Type N (m) (2 required for HP 8340B/41B) (3 required for HP 8341B with FM)	1250-1744	P, A, T
	APC-3.5 (f) to APC-3.5 (f) (2 required for HP 8340B) (1 required for HP 8341B)	5061-5311	P, A, T
	APC-3.5 (m) to APC-3.5 (m) (Only used in instruments equipped with FM - 2 required)	1250-1748	P, A, T
	APC-3.5 (m) to Type N (m) (1 required for HP 8341B LO)	1250-1743	P, A
	SMC (f) to BNC (f) SMA Male to BNC Female SMA Female to SMA Female Type N Male to BNC Female BNC Female to Dual Banana SMB (m) to SMB (m)	1250-0832 1250-1200 1250-1159 1250-1476 1251-2277 1250-0069	P P, A P P P A
Adapter Tees	BNC Male-Female-Female SMB Male-Male-Male	1250-0781 1250-0670[2]	P T
Active Probe	Input Impedance: 100 KOhms Output Impedance: 50 Ohms	HP 1121A	T, A
Probe Power Supply	For HP 1121A	HP 1122A	T, A
High Pass Filter (1 each required; use only if DUT is HP 8340B)	Frequency Range: 18.0 to 26.5 GHz Connectors: APC-3.5 Female APC-3.5 Male	HP K281C HP K281C Opt. 012	P P
Low Pass Filter	Pass 100 MHz and below Reject 150 MHz and above	9135-0260	P
Crystal Detector	Negative Frequency Range: Same as DUT	HP 8473C	P, T
Diode (2 required)	Peak Inverse Voltage: 400V Average Forward Current: 750 mA	1901-0028	P
Capacitors	1000 pF (±10%), 100 VDC 0.1 μF (±10%), 200 VDC	0160-4574 0160-0168	P A
Resistor	1 MOhm, 1%, 0.5 Watt	0757-0059	A

Table 4-2. Recommended Test Equipment (4 of 5)

Instrument	Critical Specifications	Recommended Model	Use[1]
PC Board Extenders		HP Part No.	
	24-pin	08340-60095[2]	T
	30-pin	08505-60041[2]	T
	36-pin	08505-60042[2]	T
	44-pin	08350-60031[2]	T
	48-pin	08340-60050[2]	T
	62-pin	08340-60096[2]	T
	110-pin	08340-60033[2]	T
IC Test Clip	16-pin	1400-0734[2]	T
	20-pin	1400-0979[2]	T
Adjustment Tool	Fits adjustment slot on components	8830-0024[2]	T
Service Cables	BNC (m) to SMB (f) (2 required)	85680-60093[2]	T
	SMA (m) to SMA (m) Semi-Rigid 61mm (≅2 ft) 2 required	08340-20124[2]	P, A, T
	SMB (f) to SMB (f)	5061-1022[2]	T
	Delay Line — SMA (m) to SMA (m) ≥ 1 meter (3 ft)	08503-20038[2]	P
Nut Driver	9/16-inch, to replace front panel BNC nuts	08340-20099[2]	T
Wrench	5/16-inch slotted box/open end	08555-20097[2]	T
Notch Filter	At least 35 dB rejection at 1 MHz	Locally Fabricate	P
	Construct as shown below. The filter rejection should be: ≥35 dB at 1 MHz <26 dB at 1.01 MHz		

Table 4-2. Recommended Test Equipment (5 of 5)



* Nominal value

Reference Designator	Description	HP Part No.	Qty.
C1,2	CAPACITOR-VAR CER 9-35PF	0121-0046	2
C3,6	CAPACITOR-MICA 240PF 300V	0140-0199	2
C4,7	CAPACITOR-CERAMIC 10PF 100V	0160-4791	2
C5	CAPACITOR-PE .027 μF 200V	0170-0066	1
J1,2	CONNECTOR RF MALE SMB	1250-0257	2
L1,2	COIL 100μH 5%	9140-0210	2
L3	COIL 1.0μH 5%	9100-3551	1
R1,2	RESISTOR 51.1 1% .125W	0757-0394	2

1. P=Performance Tests, HP-IB=HP-IB Operation Verification Test, A=Adjustments, T=Troubleshooting.
2. These parts are included in Service Kit HP Part Number 08340-60134.
3. For best accuracy in the Pulse Modulation Rise and Fall Time and the Amplitude Modulation Performance Tests, the Local Oscillator drive to the mixer should be ≥ +4 dBm. The HP 8340A/B Option 001, used as the LO will produce +4 dBm at any frequency. Any HP 8341A/B will provide sufficient power at all frequencies, but may be used only with an HP 8341A/B DUT.

4-1. INTERNAL TIME BASE AGING RATE

NOTE

The overall accuracy of the HP 8340B/41B 10 MHz internal time base is a function of time base calibration + aging rate ± temperature effects ± line effects.

For greatest frequency accuracy, the time base should be allowed to warm up until the output frequency has stabilized (usually 7 to 30 days) before calibrating (adjusting the time base frequency to a known standard). After calibration, the change in time base frequency should remain within the aging rate if: the time base oven is not allowed to cool down, the instrument orientation with respect to the earth's magnetic field is maintained, and the instrument does not sustain any mechanical shock. Frequency changes due to orientation with respect to the earth's magnetic field and altitude changes will usually be nullified when the instrument is returned to its original position. Frequency changes due to mechanical shock will usually appear as a fixed frequency error.

If the instrument is disconnected from ac power allowing the time base oven to cool down, it may be necessary to readjust the time base frequency after a new warmup cycle; however, in most cases, the time base frequency will return to within ± 1 Hz of the original frequency.

Specification

Table 4-3. Internal Time Base Aging Rate Specifications

Aging Rate:

1×10^{-9} per day, 2.5×10^{-7} per year after 72-hour warm up if the instrument has been disconnected from ac power for less than 24 hours. Aging rate is achieved after 7 to 30 days warm-up if the instrument has been disconnected from ac power for greater than 24 hours.

Accuracy:

Overall accuracy of internal time base is a function of time base calibration ± aging rate ± temperature effects ± line effects.

Description

A reference signal from the HP 8340B/41B under test is connected to the oscilloscope's vertical input. A frequency standard (with long term stability greater than 1×10^{-10} is connected to the oscilloscope trigger input. The time required for a specific phase change is measured immediately and after a period of time. The aging rate is inversely proportional to the absolute value of the difference in the measured times.

Equipment

Frequency Standard	HP 5061A
Oscilloscope[1]	HP 1741A

1. A 50 Ohm Feedthrough Termination (such as the HP 10100C) is required when using an oscilloscope without a 50 Ohm input. It is not required with the HP 1741A.

4-1. INTERNAL TIME BASE AGING RATE (Cont'd)

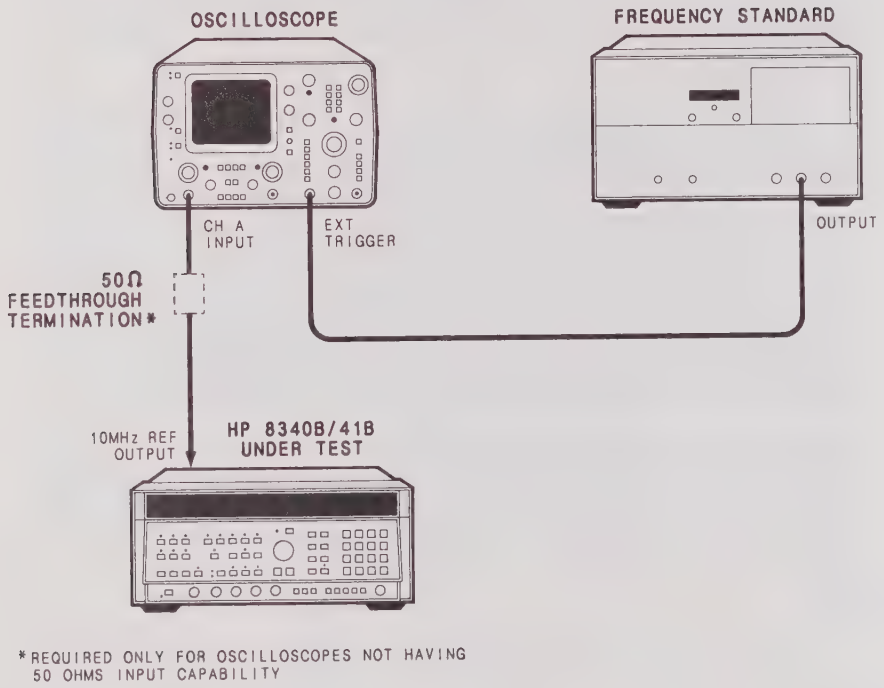


Figure 4-1. Internal Time Base Aging Rate Test Setup

NOTE

Be sure the HP 8340B/41B has been connected to the AC power line for 30 days before beginning this test. If the instrument was disconnected from the ac power line for less than 24 hours, it only has to be connected to AC power for 24 hours before proceeding.

Procedure

1. Connect the equipment as shown in Figure 4-1.
2. Adjust the oscilloscope external triggering controls for a stable display of the HP 8340B/41B 10 MHz REF OUTPUT signal.
3. Measure the time required for a phase change of 360 degrees. Record the time (T1) in seconds.

T1 = _____ second(s)

4-1. INTERNAL TIME BASE AGING RATE (Cont'd)

4. Wait for a period of time (from 3 to 24 hours) and remeasure the phase change time (repeat step 3). Record the period of time between measurements (T2) in hours and the new phase change time (T3) in seconds.

T2 = _____ hours (h)

T3 = _____ seconds (s)

5. Calculate the aging rate from the following equation:

Aging Rate = (1 cycle/f) (1/T1 − 1/T3) (T/T2)

Where: 1 cycle = the phase change reference for the time measurement. (In this case, 360 degrees)
f = HP 8340B/41B Time Base output frequency (10 MHz)
T = specified time for aging rate (24 hours)
T1 = initial time measurement (s) for 360 degree (1 cycle change)
T2 = time between measurements (h)
T3 = final time measurement (s) for a 360 degree (1 cycle) change

For example, if:

T1 = 351s
T2 = 3h
T3 = 349s

Then:

Aging Rate = (1 cycle/10 MHz) (1/351s − 1/349s) (24h/3h)

$= 1.306 \times 10^{-11}$ per day

6. Verify that the aging rate is less than $^{-9}$ per day.

NOTE

If the absolute frequencies of the frequency standard and the HP 8340B/41B Time Base oscillator are extremely close, the measurement time in steps 3 and 4 (T1 and T3) can be reduced by measuring the time required for a phase change of less than 360 degrees. change "1 cycle" in the equation accordingly (i.e., 180 degrees = 1/2 cycle, or 90 degrees = 1/4 cycle).

7. If the aging rate is not within the required tolerance, be sure sufficient warmup time has been allowed and that the environmental conditions have not changed throughout the test, then check the Time Base heater circuit and, if necessary, replace the Time Base. Refer to service and repair information for the A51 10 MHz Reference Oscillator in the Reference Loop − M/N Loop portion in Section VIII of the Service Manual.

4-2. FREQUENCY RANGE AND CW MODE ACCURACY

Specification

Table 4-4. Frequency Range and CW Mode Accuracy Specifications

Range:

HP 8340B: 0.01 to 26.50 GHz
HP 8341B: 0.01 to 20.00 GHz

Resolution: n x 1 Hz
Where N = harmonic multiplication number. Refer to Frequency Ranges and Bandswitch Points description in the specifications portion of Section I.

Accuracy: Same as Time Base Accuracy in the specifications portion of Section I.

Description

The HP 8340B/41B RF output is supplied to a frequency counter. The frequency counter internal time base is used as the reference for the DUT to eliminate time base error from the measurement. The DUT frequency display and the counter display should agree, within the resolution of each instrument. This procedure does not test for CW mode accuracy as a function of the time base accuracy.

NOTE

A fault in the DUT could cause the two displays to be different. Any fault that would cause one of the phase lock loops to be unlocked would be indicated by a front-panel UNLK indication; however, all HP 8340B/41B internal phase lock loops could be locked and the DUT output frequency could be in error (i.e., a phase lock loop frequency divider bit could be bad). If all the dividers work normally, then CW mode frequency accuracy is essentially guaranteed.

In the following procedure, the test frequencies are selected first to test the maximum frequency range and then to exercise each frequency related circuit throughout its CW range while holding all remaining circuits constant. The test frequencies are grouped so that an abnormal indication would point to the circuit most likely causing the problem.

Equipment

Frequency Counter ..... HP 5343A Option 011
Adapters
SMA (m) to BNC (f) ..... HP P/N 1250-1200
APC 3.5 (f) to APC 3.5 (f) ..... HP P/N 5061-5311
(2 required if DUT is HP 8340B)
(1 required if DUT is HP 8341B)
Type N (m) to APC 3.5 (f) ..... HP P/N 1250-1744
(1 required if DUT is HP 8341B)
Cable (Semi-Rigid SMA male to SMA male) ..... HP P/N 08340-20124

4-2. FREQUENCY RANGE AND CW MODE ACCURACY (Cont'd)

Procedure

1. Connect the equipment as shown in Figure 4-2. Connect the DUT RF Output to the 10 MHz-500 MHz counter input. Allow the equipment to warm up for one hour. The DUT and the Frequency Counter use the same frequency standard to eliminate time base error from the measurement. Set the HP 8340B/41B rear panel FREQUENCY STANDARD switch to EXT.

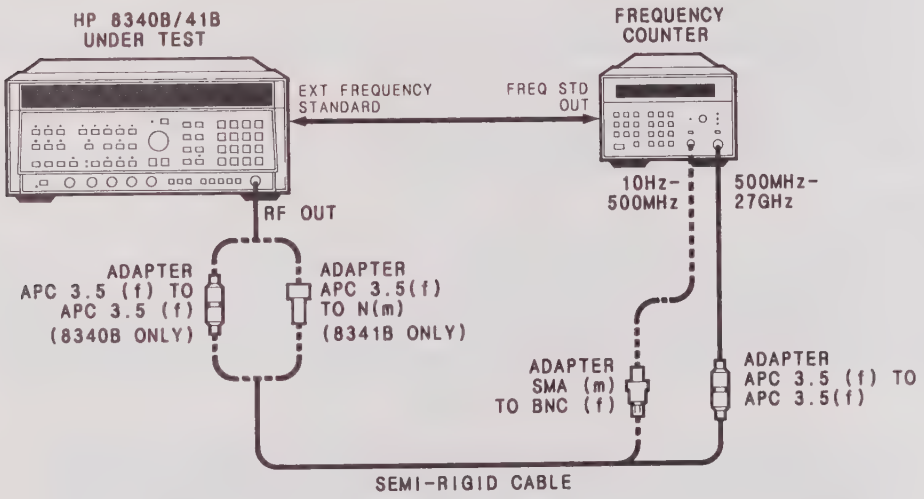


Figure 4-2. Frequency Range Test Setup

2. Press HP 8340B/41B **[INSTR PRESET]**, then **[CW]** and enter **[1] [0] [MHz]**. Press **[POWER LEVEL]** and enter **[+] [1] [0] [dBm]**. the counter should indicate 10 MHz ± 1 Hz ± the resolution of the counter.

3. Check the high frequency endpoint.

   FOR HP 8340B

   Connect the HP 8340B RF output to the 500 MHz-26.5 GHz counter input. Press the HP 8340B **[CW]** key and enter **[2] [6] [.] [5] [GHz]**. Press **[POWER LEVEL] [0] [dBm]**. The counter should indicate 26.5 GHz ±4 Hz ± the resolution of the counter.

   FOR HP 8341B

   Connect the HP 8341B RF output to the 500 MHz-26.5 GHz counter input. Press the HP 8341B **[CW]** key and enter **[2] [0] [GHz]**. Press **[POWER LEVEL] [0] [dBm]**. The counter should indicate 20.0 GHz ±3 Hz ± the resolution of the counter.

NOTE

Since the same time base is used for both the HP 8340B/41B and the frequency counter, only the displayed frequency is checked. The actual frequency error is ± (DUT output frequency/10 MHz) X time base error ± 4 Hz (HP 8340B) or 3 Hz (HP 8341B).

4. Check the M/N M Divider frequencies as follows:

NOTE

Pressing [SHIFT] [M1] displays, from left to right, the:
M divide number,
N divide number,
M/N Loop output frequency,
20/30 Loop output frequency.
Press [SHIFT] [M5] to exit this diagnostic mode. The instrument continues to operate normally while in the diagnostic mode.

a. Press **[CW]** key and enter **[2] [4] [9] [0] [MHz]**. Select a step size of 10 MHz by pressing **[SHIFT] [CF] [1] [0] [MHz]**. Press **[SHIFT] [M1]** to display, from left to right, the M divide number, the N divide number, the M/N Loop output frequency, and the 20/30 Loop output frequency. Press the **[CW]** key to display the CW frequency in the **[ENTRY DISPLAY]**.

b. Using the down arrow key, step down to 2 300.000000 MHz. Check the counter indication at each step. The counter should indicate the HP 8340B/41B frequency ± 1 Hz ± the resolution of the counter at each step.

NOTE

The above step sets and holds the N Divider to 13 and programs the M Divider through its full range of 8 to 27. Any frequency error as a result of a problem in the M Divider will probably be a multiple of 10 MHz.

c. If a significant frequency error is evident, note the conditions under which the error occurred and continue this procedure to determine if any other conditions produce an error.

5. Check the M/N N Divider frequencies as follows:

a. Select a step size of 200 MHz by pressing **[SHIFT] [CF] [2] [0] [0] [MHz]**. Press **[CW]** to display the CW frequency in the **[ENTRY DISPLAY]**. The CW frequency should be 2 300.000000 MHz.

b. Using the up arrow key, step to 6 900.000000 MHz. Check the counter indication at each step. The counter should indicate the HP 8340B/41B frequency ± 1 Hz ± the resolution of the counter.

NOTE

The above step sets and holds the M Divider to 27 and programs the N Divider through its full range of 13 to 36. Any frequency error as a result of a problem in the M Divider will probably be a multiple of 10 MHz.

c. If a significant frequency error is evident, note the conditions under which the error occurred and continue this procedure to determine if any other conditions produce an error.

6. Check the 20/30 MHz N2 loop frequencies as follows:

a. Press **[INSTR PRESET]**. Press**[CF]** key and enter **[2] [3] [1] [0] [.] [5] [MHz]**. Press the **[ΔF]** key and enter **[1] [MHz]**. Select a step size of 1 kHz by pressing **[SHIFT] [CF] [1] [kHz]**.

b. Press **[SINGLE]** sweep key to set the DUT to be phase-locked at the start of sweep (2.310 GHz]. Press **[SHIFT] [M1]** to enter the diagnostic display mode. Press **[CF]** to display the center frequency in the **[ENTRY DISPLAY]**. The center frequency should be 2.310500 GHz.

4-2. FREQUENCY RANGE AND CW MODE ACCURACY (Cont'd)

c. Using the up arrow key, step the center frequency up to 2.310510 GHz. Check the counter indication at each step. The counter should indicate the DUT start frequency (CF − 0.0005 GHz) ± 1 Hz ± the resolution of the counter.

NOTE

The above steps set the output of the M/N loop to 180 MHz where M=26 and N=13. The YO start frequency (2310 MHz) is then 20 to 30 MHz below the Nth harmonic (N=13) of 180 MHz (180 x 13 = 2340). The 20/30 MHz output is then 30 MHz. since the ΔF frequency (1 MHz) is between 0.1 to 5 MHz, the 20/30 MHz frequency is derived from the PLL2 75 to 150 MHz VCO output divided by 5 (150 MHz / 5 = 30 MHz). The PLL2 VCO frequency is stepped down in 5 kHz steps which steps the 20/30 frequency from 30 MHz down to 29.990 MHz in 1 kHz steps. Since the M/N frequency remains constant and the HP 8340B/41B output frequency is mixed with a harmonic (13th) of the M/N signal and the resultant output is phase compared to the 20/30 output, the DUT output frequency must increase by 1 kHz/step to satisfy the 20/30 phase lock loop. This checks the least significant (BCD) N2 programming bits.

To observe the N2 PLL2 VCO frequency changes, repeat the N2 loop frequency check (Step 6a through 6c) pressing [SHIFT] [M3] in step 6b rather than [SHIFT] [M1]. [SHIFT] [M3] will display, from left to right, the PLL2 VCO frequency and the PLL3 Up Converter frequency (the PLL3 UP Converter frequency display will be 0 since the PLL3 is not used in the swept mode).

d. Select a step size of 10 kHz by pressing **[SHIFT] [CF] [1] [0] [kHz]**. Press **[CF]** to display the center frequency in the **[ENTRY DISPLAY]**; the display should indicate 2.310510 GHz.

e. Using the up arrow key, step the center frequency up to 2.310600 GHz. Check the counter indication at each step. The counter should indicate the DUT start frequency (CF − 0.0005 GHz) ± 1 Hz ± the resolution of the counter.

NOTE

The above steps program the 20/30 frequency from 29.99 MHz to 29.90 MHz in 0.01 MHz steps and checks additional N2 Divider programming bits.

f. Select a step size of 100 kHz by pressing **[SHIFT] [CF] [1] [0] [0] [kHz]**. Press **[CF]** to display the center frequency in the **[ENTRY DISPLAY]**. The CF should be at 2.310600 GHz.

g. Using the up arrow key, step the center frequency up to 2.311500 GHz. Check the counter indication at each step. The counter should indicate the DUT start frequency (CF − 0.0005 GHz) ± 1 Hz ± the resolution of the counter.

NOTE

The above steps program the 20/30 frequency from 29.9 to 29.0 in 0.1 MHz steps and check additional N2 Divider programming bits.

h. Select a step size of 1 MHz (press **[SHIFT] [CF]** and enter **[1] [MHz]**). Press **[CF]** to display the center frequency in the **[ENTRY DISPLAY]**. The CF should be at 2.311500 GHz.

i. Using the up arrow key, step the center frequency up to 2.320500 GHz. Check the counter indication at each step. The counter should indicate the DUT start frequency (CF − 0.0005 GHz) ± 1 Hz ± the resolution of the counter.

NOTE

The above steps program the 20/30 frequency from 29.0 MHz to 21.0 MHz in 1 MHz steps. The last CF step programs the 20/30 to 30 MHz and the M/N frequency to 180.769231 MHz. This checks the remaining N2 Divider programming bits.

j. If a significant frequency error is evident, note the conditions under which the error occurred and continue this procedure to determine if any other conditions produce an error.

7. Check the 20/30 MHz N1 loop frequencies as follows:

a. Press **[INSTR PRESET]**. Select a step size of 10 kHz by pressing **[SHIFT] [CF] [1] [0] [kHz]**. Press **[CW]** and enter **[2] [3] [1] [9] [.] [9] [7] [MHz]**.

b. Press **[SHIFT] [M1]** to display, from left to right, the M divide number, the N divide number, the M/N Output frequency, and the 20/30 Output frequency.

c. Using the down arrow key, step the CW frequency down to 2 319.870000 MHz. Check the counter indication at each step. The counter should indicate the DUT CW frequency ± 1 Hz ± the resolution of the counter.

NOTE

The above steps set the output of the M/N loop to 180 MHz where M = 26 and N = 13. The PLL1 VCO frequency is stepped up in 100 kHz steps. This steps the 20/30 frequency up from 20.03 MHz in 10 kHz steps to 20.13 MHz. The M/N frequency remains constant and the YO frequency is mixed with a harmonic (13th) of the M/N signal. The resultant output is phase compared to the 20/30 output. The DUT output frequency must decrease by 10 kHz/step to satisfy the YO phase lock loop. This checks the least significant N1 programming bits.

d. Select a step size of 100 kHz by pressing **[SHIFT] [CF] [1] [0] [0] [kHz]**. Press the **[CW]** key to view the CW frequency in the **[ENTRY DISPLAY]**. The CW frequency should be at 2 319.870000 MHz.

e. Using the down arrow key, step the CW frequency down to 2 318.970000 MHz. Check the counter indication at each step. The counter should indicate the DUT CW frequency ± 1 Hz ± the resolution of the counter.

NOTE

The above steps program the 20/30 frequency from 20.13 up to 21.03 in 0.1 MHz steps and checks additional N1 Divider programming bits.

4-2. FREQUENCY RANGE AND CW MODE ACCURACY (Cont'd)

f. Select a step size of 1 MHz by pressing **[SHIFT] [CF] [1] [MHz]**. Press the **[CW]** key to view the CW frequency in the **[ENTRY DISPLAY]**. The CW frequency should be at 2318.97000 MHz.

g. Using the down arrow key, step the CW frequency down to 2310.970000 MHz. Check the counter indication at each step. The counter should indicate the DUT CW frequency ± 1 Hz ± the resolution of the counter.

NOTE

The above steps program the 20/30 frequency from 21.03 MHz to 29.03 MHz in 1 MHz steps and check the remaining N1 Divider programming bits.

8. If frequency errors occurred, the instrument requires service. To troubleshoot the instrument, determine what frequency related circuit is most likely to have caused the symptom (i.e., M/N Loop or 20/30 Loop) then refer to Section VIII of the Service Manual (may be ordered separately).

4-3. SWEEP TIME ACCURACY

Specification

Table 4-5. Sweep Time Accuracy Specifications

Range: 10 milliseconds to 200 seconds forward sweep times.
Accuracy: ±5% (sweeptimes ≤50 seconds)

Description

The HP 8340B/41B is swept from 3 GHz to 7 GHz at 5 different sweep times, ranging from 10 ms to 50 sec. The rear panel STOP SWEEP IN/OUT signal of the DUT is used to trigger INPUT A and B on an HP 5316A Universal Counter used in the time interval mode. At the start of a sweep, the STOP SWEEP IN/OUT signal changes from TTL low to TTL high. This pulse triggers INPUT A on the Universal Counter (selected for leading edge triggering) and the count begins. At the end of a sweep, the STOP SWEEP IN/OUT signal changes from TTL high to TTL low. At this point, INPUT B is triggered (selected for trailing edge triggering) and the count is complete. After the Universal Counter has made several counts, an accurate reading of the DUT sweep time is indicated on its display.

Figure 4-3. Sweep Time Accuracy Test Setup

Equipment

Universal Counter ..... HP 5316A

Procedure

1. Connect equipment as shown in Figure 4-3. Switch the HP 8340B/41B POWER to ON. Allow the equipment to warm up for one hour.
2. On the DUT, press **[INSTR PRESET] [START FREQ] [3] [GHz] [STOP FREQ] [7] [GHz] [POWER LEVEL] [0] [dBm]**.

4-3. SWEEP TIME ACCURACY (Cont'd)

3. Set up the 5316A as follows:

TI A→B ..... IN
GATE TIME ..... MIN
LEVEL/SENSE (CHANNEL A and B) ..... +MAX
TRIGGER (CHANNEL A and B) ..... LEVEL
AC/DC (CHANNEL A and B) ..... DC
ATTN (CHANNEL A and B) X1
FILTER ..... NORM
SEP/COM A ..... COM A
Channel A Triggering ..... Leading Edge
Channel B Triggering ..... Trailing Edge

NOTE

To ensure that an accurate sweep time indication is obtained from the HP 5316A in step 4, allow the DUT to complete at least three sweeps.

4. On the HP 8340B/41B, press **[SWEEP TIME] [1] [0] [msec]**. Verify that the sweep time displayed by the HP 5316A is within the limits shown in Table 4-6.

5. Repeat step 4 for values shown in Table 4-6.

Table 4-6. Sweep Time Accuracy Limits

Selected	Lower Limit	Upper Limit
10 ms	9.5 ms	10.5 ms
100 ms	95 ms	105 ms
1 s	.95 s	1.05 s
10 s	9.5 s	10.5 s
50 s	47.5 s	52.5 s

4-4. SWEPT FREQUENCY ACCURACY

Specification

Table 4-7. Swept Frequency Accuracy Specifications

Center Frequency/Sweep Width Mode (CF/ΔF)

Readout Accuracy with respect to sweep out voltage (sweep time > 100 milliseconds):
$\Delta F \leq n \times 5$ MHz: ± 1% of indicated sweep width (ΔF) ± time base accuracy*
$\Delta F > n \times 5$ MHz to < 300 MHz: ± 2% of indicated sweep width (ΔF)
$\Delta F \geq 300$ MHz: ± 1% of indicated sweep width (ΔF), or ± 50 MHz, whichever is less

Where n = harmonic multiplication number. Refer to Frequency Ranges and Bandswitch Points description in the specifications table in Section I.

* Time Base affects Center Frequency accuracy only, not Sweep Width Accuracy.

Start/Stop Mode

Readout Accuracy with respect to sweep out voltage (sweep time > 100 milliseconds):

Same as Center Frequency/Sweep Width Mode.

Description

The HP 8340B/41B (DUT) RF output is connected to the HP 8566B Spectrum Analyzer input. The spectrum analyzer is set for zero Hz span at a CW frequency within the DUT swept frequency range. The spectrum analyzer VIDEO OUT (applied to the oscilloscope vertical input) will have a response as the DUT output passes through the frequency that the spectrum analyzer is tuned to. The selected spectrum analyzer bandwidth filter will determine the shape of the response.

The HP 8340B/41B SWEEP OUT, in series with a power supply, is applied to an oscilloscope's horizontal input. The input to the oscilloscope is clamped at ±0.7V by two diodes to prevent overdriving the oscilloscope's input. The oscilloscope is calibrated by setting the DUT and the spectrum analyzer to the same CW frequency (e.g., 20% of Band). To set the DUT to have a SWEEP OUT voltage and at the same time a phase locked CW frequency that is proportional to a percentage of a swept frequency band, the START and STOP frequencies are selected, MANUAL SWEEP is selected, and a frequency equivalent to the desired percentage of band is selected (e.g., START 3 GHz, STOP 5 GHz, MANUAL 3.4 GHz, for 20%). The power supply is adjusted for a DVM indication of zero volts and the oscilloscope horizontal position control is used to position the dot to the center graticule line. With the oscilloscope horizontal sensitivity set to 0.05 V/Division, the CRT horizontal axis is now calibrated to approximately 0.5% of the swept frequency range per division. The spectrum analyzer VIDEO OUT voltage to the oscilloscope is then maximum and the scope vertical position is adjusted to place the dot near the top of the CRT.

The HP 8340B/41B can now be set to sweep any frequency range and the oscilloscope center graticule line will represent the calibrated percentage (e.g., 20%) of the sweep range. The spectrum analyzer center frequency is set to a frequency that is the desired percentage (e.g., 20%) of the DUT swept frequency range. If the DUT swept frequency accuracy is perfect, the oscilloscope trace will be the response of the spectrum analyzer's bandwidth filter, centered on the CRT. If the trace is not centered, the spectrum analyzer center frequency is adjusted to position the response to the center of the oscilloscope CRT. The amount of spectrum analyzer frequency change is the DUT Swept Frequency Accuracy error.

4-4. SWEPT FREQUENCY ACCURACY (Cont'd)

Since the circuitry that determines swept frequency accuracy is the same for both ΔF Mode and Start/Stop Mode, only Start/Stop Mode swept frequency accuracy is tested.

NOTE

The spectrum analyzer resolution bandwidth and DUT sweep time must be compatible to obtain the desired oscilloscope response.

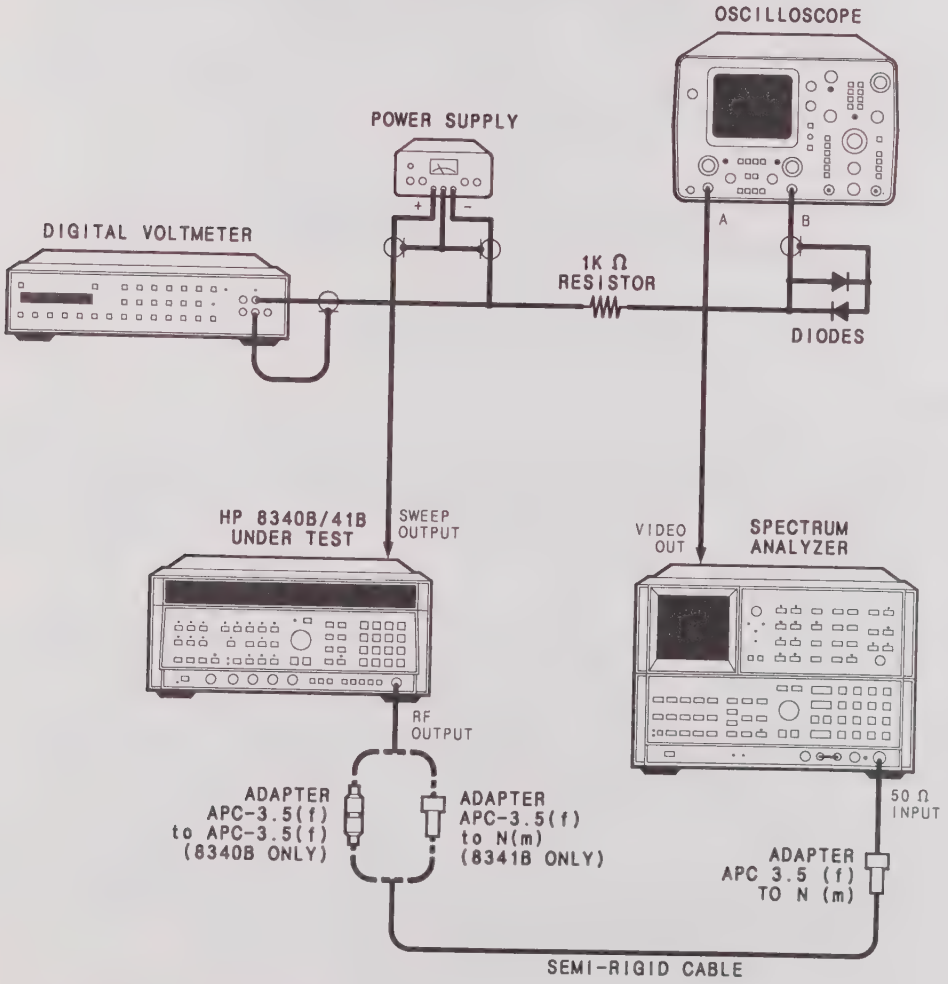


Figure 4-4. Swept Frequency Accuracy Test Setup

4-4. SWEPT FREQUENCY ACCURACY (Cont'd)

Equipment

Spectrum Analyzer	HP 8566B
Oscilloscope	HP 1741A
Power Supply	HP 6294A
Adapters	
Type N (m) to APC 3.5 (f) (2 required if DUT is HP 8341B) (1 required if DUT is HP 8340B)	HP P/N 1250-1744
APC 3.5 (f) to APC 3.5 (f) (1 required if DUT is HP 8340B)	HP P/N 5061-5311
Cable (Semi-Rigid SMA male to SMA male)	HP P/N 08340-20124
Diode (2 required)	HP P/N 1901-0028
Digital Voltmeter	HP 3456A
1 KOhm Resistor	HP P/N 0757-0280

Procedure

1. Connect the equipment as shown in Figure 4-4 (with the power supply output set to 0 Vdc). Allow the equipment to warm up for one hour.
2. Press HP 8340B/41B **[INSTR PRESET]**. Set the oscilloscope to display amplitude versus sweep out voltage (A vs B). Set channel A sensitivity to 0.2V/Div.
3. Set the spectrum analyzer REFERENCE LEVEL to 20 dBm. Set CENTER FREQUENCY to 3.4 GHz for 20% (4 GHz for 50%, or 4.6 GHz for 80%). Set FREQUENCY SPAN to zero. Set RES BW (resolution bandwidth) to 3 MHz.
4. Set HP 8340B/41B to have a sweep out voltage and at the same time, a phase locked CW frequency that is proportional to a percentage of band as follows:
   a. Press **[START]** and enter **[3] [GHz]**
   b. Press **[STOP]** and enter **[5] [GHz]**
   c. Press **[MANUAL]** SWEEP and enter **[3] [.] [4] [GHz]** for 20% (4 GHz for 50%, or 4.6 GHz for 80%).

CAUTION

Do not adjust the power supply for greater than ±10 Vdc in this procedure.

5. Adjust the oscilloscope's Channel B sensitivity for 0.05 V/DIV and the horizontal position control for midrange. Adjust the power supply voltage for a DVM indication of 0±10 mVdc.
6. Adjust oscilloscope horizontal position control to position the dot on the center graticule. Adjust the oscilloscope vertical position to place the dot near the top of the CRT.

NOTE

The oscilloscope is now calibrated for 0.5%/Division and for the desired percentage of band (i.e., 20%, 50%, or 80%). Measurements can now be made at this percentage of band for any Start/Stop frequency and any frequency span.

4-4. SWEPT FREQUENCY ACCURACY (Cont'd)

7. Refer to Table 4-8, press the HP 8340B/41B **[START FREQ]** key and enter the start frequency shown in Table 4-8. Press the **[STOP FREQ]** key and enter the appropriate stop frequency. Press the **[SWEEP TIME]** key and enter the appropriate sweep time. Select the appropriate spectrum analyzer resolution bandwidth. Set the spectrum analyzer center frequency to the appropriate frequency for the percentage of band being tested. Press the HP 8340B/41B **[CONT]** key to return to the swept mode. Stop Frequencies greater than 20.0 GHz only apply to the HP 8340B.

8. Ideally, the oscilloscope response will be at the center graticule line, if not, adjust the spectrum analyzer center frequency to bring the oscilloscope response to the center graticule line. The difference between the original center frequency setting and present center frequency is the HP 8340B/41B swept frequency error. This error should be within the test limit shown in Table 4-8.

9. Repeat steps 3 through 8 to test at 50% and 80% of band.

NOTE

If the swept frequency accuracy error exceeds the test limit, refer to the Sweep Gain and Delay Adjustments, in Section V, Adjustments in the Service Manual.

Table 4-8. Swept Frequency Accuracy Test Frequencies

DUT			Spectrum Analyzer				Test Limit (kHz)
Start Freq (GHz)	Stop Freq (GHz)	Sweep Time (ms)	Center Frequency (GHz)			Res BW (kHz)	
			20% of Band	50% of Band	80% of Band		
2.3	2.300099	3000	2.3000198	2.3000495	2.300792	0.3	±0.99
2.3	2.300101	3000	2.3000202	2.3000505	2.3000808	0.3	±1.01
2.3	2.300499	1000	2.3000998	2.3002495	2.3003992	1.0	±4.99
2.3	2.300501	1000	2.3001002	2.3002505	2.3004008	1.0	±5.01
2.3	2.30499	300	2.300998	2.302495	2.303992	3.0	±49.9
2.3	2.30501	300	2.301002	2.302505	2.304008	3.0	±100.02
2.3	2.31	300	2.302	2.305	2.308	3.0	±200
2.3	2.32	100	2.304	2.310	2.316	10	±400
2.3	2.33	100	2.306	2.315	2.324	10	±600
2.3	2.34	100	2.308	2.320	2.332	30	±800
2.3	2.349	100	2.3098	2.3245	2.3392	30	±998
2.3	2.3501	100	2.31002	2.32505	2.34008	30	±1020
2.3	2.36	100	2.312	2.33	2.348	30	±1200
2.3	2.37	100	2.314	2.335	2.356	30	±1400
2.3	2.38	100	2.316	2.34	2.364	30	±1600
2.3	2.39	100	2.318	2.345	2.372	30	±1800
2.3	2.3999	100	2.31998	2.34995	2.37992	30	±1980
2.3	2.4001	100	2.32002	2.35005	2.38008	100	±2002
2.3	2.799	100	2.3998	2.5495	2.6992	1000	±4990
2.3	2.801	100	2.4002	2.5505	2.7008	1000	±5010
2.3	7.29	100	3.298	4.795	6.292	3000	±49900
2.3	7.31	100	3.302	4.805	6.308	3000	±50000
2.3	8.3	100	3.500	5.300	7.100	3000	±50000
2.3	16.452	100	5.1304	9.376	13.6216	3000	±50000
2.3	20.0	100	5.84	11.15	16.46	3000	±50000
2.3	24.55[1]	100	6.75	13.425	20.1	3000	±50000
2.3	26.5[1]	100	7.14	14.4	21.66	3000	±50000

1. Applies to 8340B only.

4-5. MAXIMUM LEVELED OUTPUT POWER AND POWER ACCURACY TEST

Specification

Table 4-9. Maximum Leveled Output Power and Power Accuracy Specifications (1 of 2)

MAXIMUM LEVELED POWER (0°C to +35°C)	**Bands and Approximate Frequency Ranges (GHz)** (see Frequency Ranges and Bandswitch Points for complete description)					
	Band 0	**Band 1**	**Band 2**	**Band 3**	**Band 4[1]**	
	0.01 to <2.3	**2.3 to <7.0**	**7.0 to <13.5**	**13.5 to <20.0**	**20.0 to <23.0**	**23.0 to 26.5**
STANDARD INSTRUMENT	+10.0 dBm	+12.0 dBm	+10.0 dBm	+9.0 dBm	+3.0 dBm	+1.0 dBm
OPTION 001 (F.P. Out w/o Atten.)	+10.0 dBm	+13.0 dBm	+12.0 dBm	+11.0 dBm	+6.0 dBm	+4.0 dBm
OPTION 004 (R.P. Out w/Atten.)	+10.0 dBm	+11.0 dBm	+9.0 dBm	+7.0 dBm	+1.0 dBm	−1.0 dBm
OPTION 005 (R.P. Out w/o Atten.)	+10.0 dBm	+12.0 dBm	+11.0 dBm	+9.0 dBm	+4.0 dBm	+2.0 dBm

OUTPUT POWER ACCURACY[2]	**Bands and Approximate Frequency Ranges (GHz)** (see Frequency Ranges and Bandswitch Points for complete description)		
	Band 0 0.01 to < 2.3	**Bands 1-3 2.3 to <20**	**Band 4[1] 20 to 26.5**
STANDARD INSTRUMENT			
+18 to +10 dBm[3]	—	± 1.8 dB	± 2.3 dB
+10 to −9.95 dBm	± 0.9 dB	± 1.5 dB	± 2.0 dB
−10 to −19.95 dBm	± 1.2 dB	± 2.0 dB	± 2.5 dB
−20 to −49.95 dbm	± 1.5 dB	± 2.3 dB	± 2.8 dB
−50 to −79.95 dBm	± 1.8 dB	± 2.6 dB	± 3.1 dB
−80 to −100 dBm	± 2.1 dB	± 2.9 dB	± 3.4 dB
OPTION 004 (Rear Panel Output w/Atten.)			
+18 to +10 dBm[3]	—	± 2.0 dB	± 2.5 dB
+10 to −11.95 dBm	± 1.0 dB	± 1.7 dB	± 2.2 dB
−12 to −21.95 dBm	± 1.3 dB	± 2.2 dB	± 2.7 dB
−22 to −51.95 dBm	± 1.6 dB	± 2.5 dB	± 3.0 dB
−52 to −81.95 dBm	± 1.9 dB	± 2.8 dB	± 3.3 dB
−82 to − 100 dBm	± 2.2 dB	± 3.1 dB	± 3.6 dB
OPTION 001 (Front Panel Output w/o Atten.)			
+18 to +10 dBm[3]	—	± 1.6 dB	± 2.0 dB
+10 to −10 dBm	± 0.9 dB	± 1.3 dB	± 1.7 dB
−10 to −20 dBm	± 1.7 dB	± 2.1 dB	± 2.5 dB
OPTION 005 (Rear Panel Output w/o Atten.)			
+18 to +10 dBm[3]	—	± 1.8 dB	± 2.2 dB
+10 to −10 dBm	± 1.0 dB	± 1.5 dB	± 1.9 dB
−10 to −20 dBm	± 1.8 dB	± 2.3 dB	± 2.7 dB

4-5. MAXIMUM LEVELED OUTPUT POWER AND POWER ACCURACY TEST (Cont'd)

Table 4-9. Maximum Leveled Output Power and Power Accuracy Specifications (2 of 2)

FLATNESS (Internally Leveled)			
STANDARD INSTRUMENT (Front Panel Output w/Atten.)	**Band 0 0.01 to <2.3**	**Bands 1 - 3 2.3 to <20**	**Band 4[1] 20 to 26.5**
+18 to +10 dBm[3]	—	±1.2 dB	±1.7 dB
+10 to −9.95 dBm	±0.6 dB	±1.1 dB	±1.6 dB
−10 to −19.95 dBm	±0.9 dB	±1.6 dB	±2.1 dB
−20 to −49.95 dBm	±1.2 dB	±1.9 dB	±2.4 dB
−50 to −79.95 dBm	±1.4 dB	±2.2 dB	±2.7 dB
−80 to −100 dBm	±1.7 dB	±2.5 dB	±3.0 dB
OPTION 004 (Rear Panel Output w/Atten.)			
+18 to +10 dBm[3]	—	±1.4 dB	±1.9 dB
+10 to −11.95 dBm	±0.7 dB	±1.3 dB	±1.8 dB
−12 to −21.95 dBm	±1.0 dB	±1.8 dB	±2.3 dB
−22 to −51.95 dBm	±1.3 dB	±2.1 dB	±2.6 dB
−52 to −81.95 dBm	±1.5 dB	±2.4 dB	±2.9 dB
−82 to −100 dBm	±1.8 dB	±2.7 dB	±3.2 dB
OPTION 001 (Front Panel Output w/o Atten.)			
+18 to +10 dBm[3]	—	±1.0 dB	±1.4 dB
+10 to −10 dBm	±0.6 dB	±0.9 dB	±1.3 dB
−10 to −20 dBm	±0.8 dB	±1.5 dB	±1.9 dB
OPTION 005 (Rear Panel Output w/o Atten.)			
+18 to +10 dBm[3]	—	±1.2 dB	±1.6 dB
+10 to −10 dBm	±0.7 dB	±1.1 dB	±1.5 dB
−10 to −20 dBm	±0.9 dB	±1.7 dB	±2.1 dB

NOTES

1. Applies only to HP 8340B
2. Internally leveled, AM off. The POWER dBm display monitors the actual output power, giving accurate readings when unleveled, externally leveled, or when amplitude modulating with a signal that has a dc component. The ENTRY DISPLAY shows the desired power level, or the desired external detector output voltage, exclusive of modulation.
3. The ALC loop typically operates up to +20 dB to enhance usability at those frequencies where leveled power greater than the maximum specified is available.

4-5. MAXIMUM LEVELED OUTPUT POWER AND POWER ACCURACY TEST (Cont'd)

Description

MAXIMUM LEVELED POWER

For maximum leveled power, a crystal detector and an oscilloscope are used to monitor the swept response. The DUT is set to sweep a given frequency band. The power level is increased until the DUT's UNLEVELED indicator comes on, then decreased until the UNLEVELED indicator just goes out. The maximum leveled power may differ with sweep mode and sweep time. To find the worst case, the maximum leveled power is checked in three modes: single sweep with auto sweep time, single sweep with a two second sweep time, and continuous sweep. The worst case mode is selected, and a frequency marker is positioned at the minimum power point on the swept display. The DUT is set to CW at the marker frequency and the power is measured using a power meter. The power meter indication should be greater than or equal to the maximum leveled power specification. This procedure is repeated for each frequency band.

FLATNESS

Flatness is measured with the RF output level at 0 dBm. Flatness is primarily a function of the RF path; therefore, the response will be essentially the same at all ALC levels. However, the response will most likely change when the RF Attenuator is stepped to a different attenuation level.

A power meter is used to measure the RF signal level. An oscilloscope, connected to the power meter recorder output, is used to find the frequencies where the maximum and minimum points of the response occur. The DUT is set to a slow sweep to allow the power meter to respond to any power variations. A marker is positioned at the maximum and minimum points on the oscilloscope display. The DUT is then set to CW at each of the marker frequencies and the power indications are recorded. The maximum power level minus the minimum power level should be within the flatness specification.

ACCURACY

The absolute power level at the maximum and minimum points should be within the accuracy specification.

Two different Power Sensors may be required to cover the complete frequency range. The HP 8481A Power Sensor is used from 10 MHz to 50 MHz and the HP 8485A Power Sensor is used for the other frequency bands covering 50 MHz to maximum output frequency of the DUT. The 8485A Power Sensor can be used down to 10 MHz, but if a minimum or maximum that is close to the test limits occurs in this frequency range, the 8481A Power Sensor should be used.

Equipment

Oscilloscope	HP 1741A
Attenuator	HP 8493C Opt. 010
Crystal Detector	HP 8473C
Power Meter	HP 436A Option 022
Power Sensor	HP 8481A
Power Sensor	HP 8485A
Adapters	
APC 3.5 (f) to APC 3.5 (f) (1 required if DUT is HP 8340B)	HP P/N 5061-5311
TYPE N (m) to APC 3.5 (f) (1 required if DUT is HP 8341B)	HP P/N 1250-1744
SMC (f) to BNC (f)	HP P/N 1250-0832

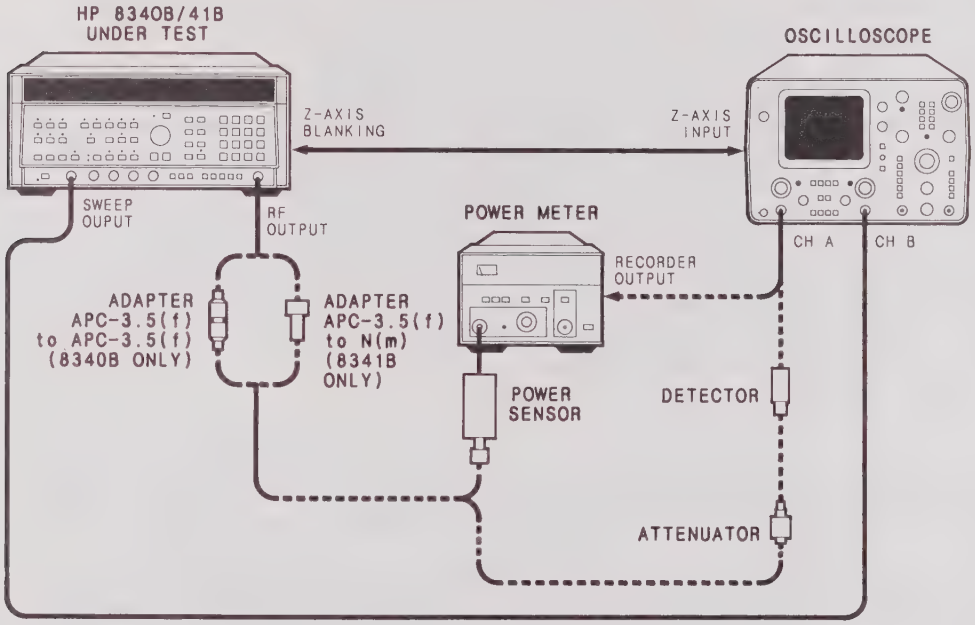


Figure 4-5. Maximum Leveled Output Power and Power Accuracy Test Setup

Procedure

MAXIMUM LEVELED POWER

1. Connect the equipment as shown in Figure 4-5. Connect the 10 dB pad and crystal detector to the DUT RF output and connect the detector output to the oscilloscope channel A input. Allow the equipment to warm up for one hour.

2. Press **[INSTR PRESET]**. Press **[PEAK]** on. Press **[STOP FREQUENCY]** and enter **[2] [.] [3] [GHz]**. Adjust the oscilloscope to view the swept output of the crystal detector.

   In Band 0 (10 MHz to 2.3 GHz), the crystal detector may pass a portion of the RF signal. This RF feedthrough may be visible on the low frequency portion of the oscilloscope trace.

   Also, as the power in Band 0 is increased toward maximum leveled, the level of the harmonics may increase and cause a perturbation in the swept response. This will cause the maximum power indication on the oscilloscope to increase without causing the UNLEVELED indicator to light. Therefore, flatness is only specified at $\leq +10$ dBm in Band 0.

3. Press the **[POWER LEVEL]** key and, using the front panel rotary knob, increase the power level until the UNLEVELED indicator comes on. Slowly decrease the power level until the UNLEVELED indicator just goes off. Note the ENTRY DISPLAY power indication.

4-5. MAXIMUM LEVELED OUTPUT POWER AND POWER ACCURACY TEST (Cont'd)

NOTE

The maximum leveled power indication may differ with sweep mode and sweep time. To find the worst case, the maximum leveled power is checked in continuous sweep with auto sweep time (step 3), single sweep with auto sweep time (step 4), and single sweep with a two second sweep time (step 5).

4. Press **[SINGLE SWEEP]** repeatedly and repeat step 3.

5. Press **[SWEEP TIME]** and enter **[2] [sec]**. Repeat step 3.

6. Select the mode that gave the worst case maximum leveled power indication (lowest ENTRY DISPLAY indication). Press **[M2]** and use the rotary knob to position the marker to the minimum power level point on the oscilloscope trace (for a negative polarity crystal detector, this is the highest point on the display, for a positive polarity detector, this is the lowest point on the display). Using the oscilloscope vertical position control, position the marker on a horizontal graticule line. Note the marker frequency. Press **[MANUAL]** and enter the frequency noted for M2. Due to SYTM tracking, the RF output level at a single frequency may be greater than in a swept mode. therefore, if the oscilloscope now indicates a higher power level than the swept response (for a positive polarity detector, the trace moves down), press **[POWER LEVEL]** and (using the rotary knob) adjust the power level to return the dot on the oscilloscope to the horizontal reference line for the minimum swept power point.

7. Disconnect the 10 dB pad and crystal detector and connect the Power Sensor to the DUT RF output. Set the Power Meter's calibration factor switch to include the frequency noted for M2.

   To obtain the most accurate Power Meter reading, zero the Power Meter on the range being used. To zero the Power Meter, press the Power Meter RANGE HOLD, press DUT **[RF]** off, zero the Power Meter, and press **[RF]** on.

   The Power Meter indication should be equal to or greater than the maximum leveled power specification. If the DUT does not meet its maximum leveled power specification, refer to SRD Bias and SYTM Tracking adjustments in Section V.

8. Press the**[START FREQ]** key and enter the start frequency for the next band. Press the **[STOP FREQUENCY]** key and enter the stop frequency for the next band. Repeat steps 3 through 7 until all frequency bands have been checked.

FLATNESS

9. Flatness is measured with the RF output level at 0 dBm. Flatness is primarily a function of the RF path; therefore, the response will be essentially the same at all ALC levels. Although the ALC accuracy is not specified separately, the ALC accuracy is typically <0.15 dB for RF output levels from $+10$ dBm to -9.95 dBm.

   To test ALC accuracy, step the DUT's RF power in 1 dB steps from $+10$ to -9.95 dBm (note, for instruments with front panel RF output, that as the power steps from -9.95 to -10 dBm, the RF attenuator is set to 10 dB and the ALC is set to 0 dBm). If the power meter indication is >0.15 dB from the ENTRY DISPLAY indication, refer to the ALC adjustments in Section V (in the Service Manual).

If the ALC accuracy is tested, frequency response must be considered; therefore, use the 0 dBm power meter indication as a reference.

Also it should be noted that the power level in the ENTRY DISPLAY is the requested power level. In normal ALC modes, the instrument processor duplicates the ENTRY DISPLAY power level in the POWER dBm display with 0.1 dB resolution; however, if AM is selected, the processor reads the ALC level with the A/D converter, calculates the associated power level, and displays the calculated value in the POWER dBm display.

10. Press **[INSTR PRESET]**. Press **[PEAK]** on. Press **[STOP FREQUENCY]** and enter **[2] [.] [3] [GHz]**. Press **[POWER LEVEL]** and enter **[0] [dBm]**.

11. Press the **[SWEEP TIME]** key and enter **[2] [sec]**.
12. Adjust the oscilloscope controls to view the Power Meter RECORDER OUTPUT voltage versus the DUT's SWEEP OUTPUT voltage (A versus B). The oscilloscope vertical gain and position must be changed as a function of the power meter range and RECORDER OUTPUT voltage.

13. Press Frequency Marker key **[M2]** and, using the rotary knob, change the marker frequency to position the (intensified) marker on the lowest point on the oscilloscope trace. It may be necessary to adjust the oscilloscope INTENSITY to view the marker dot.

14. Note the marker frequency. Press the **[MANUAL]** key and enter the frequency noted for M2. Reset the power meter calibration factor switch to include this frequency. The power meter indication is the minium power point. Record the power meter indication on the work sheet provided in Table 4-10.

NOTE

For Band 0 (10 MHz to 2.3 GHz), if the minimum or maximum power occurred below 50 MHz, use the HP 8481A Power Sensor to measure the power level.

15. Press the **[CONT]** key to return to the sweep mode. Press **[M1]** and, using the rotary knob, change the marker frequency to position the marker on the highest point on the oscilloscope trace. Note the marker frequency. Press the **[MANUAL]** key and enter the frequency noted for M1. Reset the power meter calibration factor switch to include this frequency. The power meter indication is the maximum power point. Record the power meter indication on the work sheet.

16. Press the **[CONT]** key to return to the swept mode. Press the **[START FREQ]** key and enter the start frequency for the next frequency band. Press the **[STOP FREQ]** key and enter the stop frequency for the next frequency band.

17. Repeat steps 12 through 16 to measure the flatness until all frequency bands have been checked.

18. The maximum minus the minimum power meter indications should be within the flatness specifications. If the DUT does not meet its flatness specification, refer to Flatness Adjustments in Section V of the Service Manual.

ACCURACY

19. The absolute power level at the maximum and minimum points should be within the accuracy specification. This test may be repeated at other ALC power levels (+10 dBm to −9.95 dBm) to verify flatness and accuracy specifications over the ALC range.

Table 4-10. Maximum Leveled Output Power Test Work Sheet

Frequency Range: 10 MHz to 2.3 GHz

		Power Meter Indication	HP 8340B/41B Entry Display
Step 14	Minimum	_____	_____
Step 15	Maximum	_____	_____
Step 18	Flatness:		
	Maximum - Minimum	_____	(≤1.2 dB, Standard) (≤1.4 dB, Option 004) (≤1.2 dB, Option 001) (≤1.4 dB, Option 005)

Frequency Range: 2.3 GHz to 7.0 GHz

		Power Meter Indication	HP 8340B/41B Entry Display
Step 14	Minimum	_____	_____
Step 15	Maximum	_____	_____
Step 18	Flatness:		
	Maximum - Minimum	_____	(≤2.2 dB, Standard) (≤2.6 dB, Option 004) (≤1.8 dB, Option 001) (≤2.2 dB, Option 005)

Frequency Range: 7.0 GHz to 13.5 GHz

		Power Meter Indication	HP 8340B/41B Entry Display
Step 14	Minimum	_____	_____
Step 15	Maximum	_____	_____
Step 18	Flatness:		
	Maximum - Minimum	_____	(≤2.2 dB, Standard) (≤2.6 dB, Option 004) (≤1.8 dB, Option 001) (≤2.2 dB, Option 005)

Frequency Range: 13.5 GHz to 20.0 GHz

		Power Meter Indication	HP 8340B/41B Entry Display
Step 14	Minimum	_____	_____
Step 15	Maximum	_____	_____
Step 18	Flatness:		
	Maximum - Minimum	_____	(≤2.2 dB, Standard) (≤2.6 dB, Option 004) (≤1.8 dB, Option 001) (≤2.2 dB, Option 005)

Frequency Range: 20.0 GHz to 26.5 GHz (Applies to the HP 8340B only)

		Power Meter Indication	HP 8340B Entry Display
Step 14	Minimum	_____	_____
Step 15	Maximum	_____	_____
Step 18	Flatness:		
	Maximum - Minimum	_____	(≤3.2 dB, Standard) (≤3.6 dB, Option 004) (≤2.6 dB, Option 001) (≤3.0 dB, Option 005)

4-6. EXTERNAL LEVELING

Specification

Table 4-11. External Leveling Specifications

XTAL: Allows the HP 8340B/41B to be externally leveled by crystal detectors of positive or negative polarity.

METER: Allows power meter leveling with any HP power meter.

Range (XTAL or METER): 500 microvolts (−66 dBV) to 2.0 volts (+6 dBV)

Accuracy of voltage at EXT INPUT connector relative to the displayed level (leveling voltage is shown in ENTRY DISPLAY in dBV): ±0.5 dB ± 200 microvolts.

Description

The HP 8340B/41B external leveling circuit is designed to maintain a constant voltage at the EXT INPUT BNC. This is achieved by first selecting a voltage (in dBV) to which the EXT INPUT will be leveled. This establishes a reference voltage for the ALC. The voltage at the EXT INPUT is then routed through the external leveling circuitry to the ALC and compared to the reference. If a differnce between the two voltages exist, the HP 8340B/41B RF OUTPUT power will be adjusted to compensate for the difference.

The HP 8340B/41B's external leveling circuit allows a positive or negative crystal detector to be used in the external leveling loop. A negative crystal detector (HP 8473C) is used in this test but a crystal detector may be substituted.

The HP 8340B/41B XTAL Leveling mode is selected to verify the instrument's external leveling specification. Nine different dBV values, ranging from +6 dBV to −66 dBV, are selected and the voltage accuracy at the EXT INPUT is checked with a DVM.

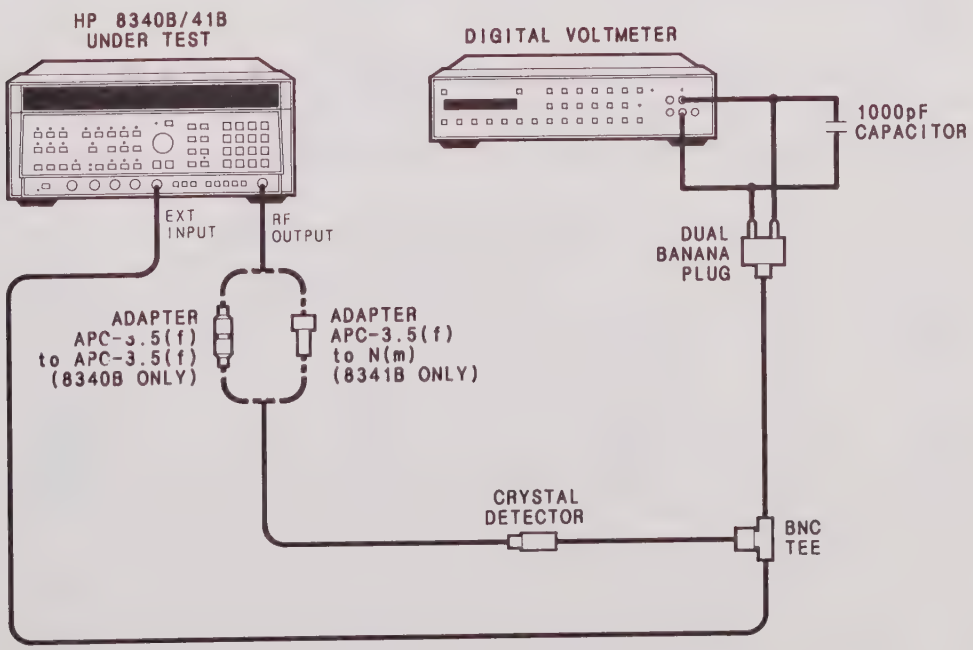


Figure 4-6. External Leveling Test Setup

4-6. EXTERNAL LEVELING (Cont'd)

Equipment

Digital Voltmeter (DVM) ..... HP 3456A
Crystal Detector ..... HP 8473C
Capacitor (1000 pF) ..... HP P/N 0160-4574
Adapters
  APC 3.5 (f) to APC 3.5 (f) ..... HP P/N 5061-5311
    (1 required if DUT is HP 8340B)
  TYPE N (m) to APC 3.5 (f) ..... HP P/N 1250-1744
    (1 required if DUT is HP 8341B)
  BNC (f) to Dual Banana ..... HP P/N 1251-2277
  BNC Tee (m) (f) (f) ..... HP P/N 1250-0781
Attenuators (required for Option 001 or Option 005 only)
  10 dB ..... HP 8493C Opt. 010
  20 dB ..... HP 8493C Opt. 020

Procedure

1. Turn DUTs LINE switch ON. Press **[INSTR PRESET] [CW] [4] [.] [5] [GHz] [POWER LEVEL] [0] [dB(m)]**.

2. Connect equipment as shown in Figure 4-6 (note 1000 pF capacitor shunting DVM input). Allow the equipment to warm up for one hour.

NOTE

In step 3, XTAL mode is selected. In this mode the [dB(m)] terminator key selects dBV. The dBV value selected corresponds to a voltage at which the DUT's EXT INPUT will be leveled (see Table 4-14). The selected dBV is displayed in the ENTRY DISPLAY.

NOTE

If a positive polarity crystal detector is being used for this test, the voltages given in Tables 4-12, 4-13, 4-14, and 4-15 will all be positive.

3. Press **[XTAL] [6] [dB(m)]**. DVM reading should be within the values shown on the first line in Table 4-12.

Table 4-12. External Leveling Limits (With No Attenuator)

dBV Selected	DVM Indication (V)		
	Lower Limit	Ideal	Upper Limit
+6	−1.883	−1.995	−2.114
0	−0.944	−1.000	−1.059
−10	−0.2983	−0.3162	−0.3352
−20	−0.0942	−0.01000	−0.1061

4-6. EXTERNAL LEVELING (Cont'd)

4. Repeat Step 3 for the remaining dBV values shown in Table 4-12.

5. Press the down step key to select 10 dB of attenuation (Option 001 and 005 instruments do not include an internal attenuator. For these instruments install a 10 dB attenuator between the RF output and detector).

6. Repeat Step 3 for values shown in Table 4-13.

7. Press the down step key to select 20 dB of attenuation (for Option 001 or 005 instruments, remove 10 dB attenuator installed in step 5 and replace it with a 20 dB attenuator).

8. Repeat Step 3 for values shown in Table 4-14.

Table 4-13. External Leveling Limits (With 10 dB Attenuator)

dBV Selected	DVM Indication (mV)		
	Lower Limit	Ideal	Upper Limit
−30	−29.65	−31.62	−33.70
−40	−9.24	−10.00	−10.79

Table 4-14. External Leveling Limits (With 20 dB Attenuator)

dBV Selected	DVM Indication (mV)		
	Lower Limit	Ideal	Upper Limit
−50	−2.785	−3.162	−3.550
−60	−0.744	−1.000	−1.259
−66	−0.273	−0.501	−0.731

4-6. EXTERNAL LEVELING (Cont'd)

Table 4-15. dBV vs. Voltage Reference Table

dBV	Voltage	dBV	Voltage
7	−2.239V	−12	−0.2512V
6	−1.995V	−19	−0.1122V
5	−1.778V	−20	−0.1000V
4	−1.585V	−21	−89.13mV
3	−1.413V	−29	−35.48mV
2	−1.259V	−30	−31.62mV
1	−1.122V	−31	−28.18mV
0	−1.000V	−39	−11.22mV
−1	−0.8913V	−40	−10.00mV
−2	−0.7943V	−41	−8.913mV
−3	−0.7079V	−49	−3.548mV
−4	−0.6310V	−50	−3.162mV
−5	−0.5623V	−51	−2.818mV
−6	−0.5012V	−59	−1.122mV
−7	−0.4467V	−60	−1.000mV
−8	−0.3981V	−61	−0.8913mV
−9	−0.3548V	−65	−0.5623mV
−10	−0.3162V	−66	−0.5012mV
−11	−0.2818V	−67	−0.4467mV

4-7. SPURIOUS SIGNALS TEST (10 MHz to 22 GHz - HP 8340B only) (10 MHz to 20 GHz - HP 8341B)

Specification

Table 4-16. Spurious Signals Test Specifications

SPURIOUS SIGNALS (Expressed in dB relative to the carrier level (dBc) at ALC level of 0 dBm)	**Bands and Approximate Frequency Ranges (GHz)** (See Frequency Ranges and Bandswitch Points for complete description)				
	Band 0 0.01 to <2.3	**Band 1 2.3 to <7.0**	**Band 2 7.0 to <13.5**	**Band 3 13.5 to <20.0**	**Band 4[1] 20.0 to 26.5**
Harmonics (up to max. output freq.)	<−35	<−35	<−35	<−35	<−35
Subharmonics and multiples thereof (up to max. output freq.)	–	–	<−25	<−25	<−20
Non-harmonically related spurious (CW and Manual Sweep mode only)	<−50	<−70	<−64	<−60	<−58
Power line related and spurious due to fan rotation within 5 Hz below line frequency, and multiples thereof (CW mode only, all power levels)					
STANDARD INSTRUMENT					
Offset <300 Hz from carrier	<−50	<−50	<−44	<−40	<−38
Offset 300 Hz to 1 kHz from carrier	<−60	<−60	<−54	<−50	<−48
Offset > 1 kHz from carrier	<−65	<−65	<−59	<−55	<−53

1. Band 4 applies to HP 8340B only.

Description

The HP 8340B/41B RF output signal is displayed on a spectrum analyzer to verify that the harmonic and non-harmonic spurious signals are at or below the specified level.

Equipment

Spectrum Analyzer . . . . . HP 8566B
Adapters
TYPE N (m) to APC 3.5 (f) . . . . . HP P/N 1250-1744
(2 required if DUT is HP 8341B)
(1 required if DUT is HP 8340B)
APC 3.5 (f) to APC 3.5 (f) . . . . . HP P/N 5061-5311
(1 required if DUT is HP 8340B)
Cable (Semi-Rigid SMA male to SMA male) . . . . . HP P/N 08340-20124

4-7. SPURIOUS SIGNALS TEST (10 MHz to 22 GHz - HP 8340B only) (10 MHz to 20 GHz HP 8341B)

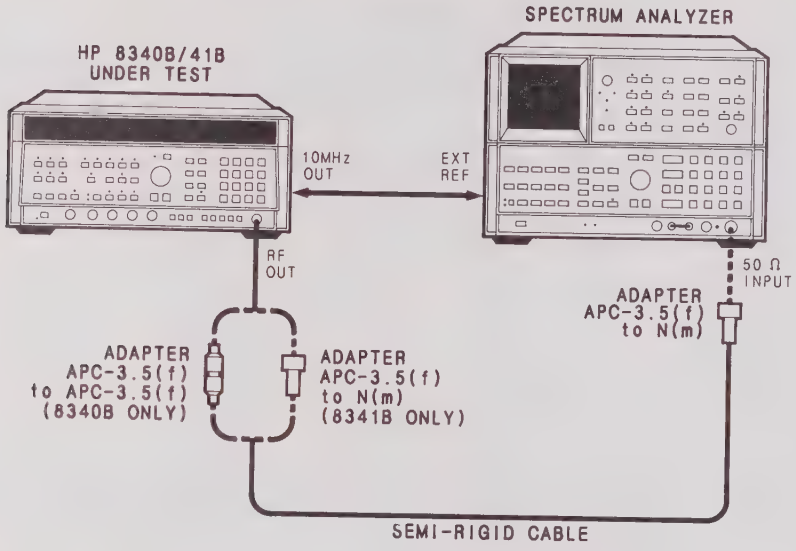


Figure 4-7. Spurious Signals Test Setup (10 MHz to 22 GHz - HP 8340B) (10 MHz to 20 GHz - HP 8341B)

Procedure

1. Connect equipment as shown in Figure 4-7. The position of the DUT can affect spurious responses; therefore, place the DUT in its normal operating position (i.e., flat on its feet) for this test. Allow the instruments to warm up for one hour.
2. Press **[INSTR PRESET]** on the DUT. Press the **[STOP FREQ]** key and enter **[2] [.] [3] [GHz]**.
3. Press the DUT's **[POWER LEVEL]** key and enter **[0] [dBm]**.
4. Press the **[CW]** key and enter any frequency of interest within the selected frequency range.
5. Set up the spectrum analyzer to view the DUT's RF output signal. Set the reference level to place the peak of the DUT's RF output signal on the reference level at the top graticule line.

4-7. SPURIOUS SIGNALS TEST (10 MHz to 22 GHz - HP 8340B only) (10 MHz to 20 GHz - HP 8341B)

NOTE

When using a spectrum analyzer other than the HP 8566A/B, the spectrum analyzer may generate some mixing products that could appear on the display. If a signal is in question, increase the spectrum analyzer input attenuation by 10 dB, note if signal decreases in amplitude by 10 dB, then return the attenuator to its original position. If the signal in question comes from an external source, it will change by exactly 10 dB. If the signal in question originates in the spectrum analyzer, the level will either change by greater or less than 10 dB or may not change at all.

The DUT's rotary knob circuit may generate some noise spikes when the knob is rotated. These signals should disappear when rotation is stopped.

If a spurious signal is found and it appears out of specification, check the fundamental signal amplitude to ensure it is at 0 dBm. Then check spurious level by substituting a known amplitude signal on the spectrum analyzer.

6. Tune the spectrum analyzer across its full frequency range. Look for any spurious signals. For each spurious response determine what mechanism generated the spurious response and what specification applies.

   a. Is the spurious response in question an integer multiple of the HP 8340B/41B RF output signal? If it is, the "harmonic" specification applies.

   b. Press the DUT's **[SHIFT]** key and then **[M2]** to display, from left to right, the YO harmonic number and the YO frequency. Is the spurious response in question an integer multiple of the YO frequency (and not a harmonic of the RF signal)? If it is the "subharmonic and multiples thereof" specification applies.

   NOTE

   Press the [CW] key to view the CW frequency in the ENTRY DISPLAY.

   c. If the spurious response in question does not meet one of the above criteria, the "non-harmonically related" specification applies.

7. Repeat steps 4 through 7 at any frequency of interest within this frequency band.

8. Press the DUT's **[STOP FREQ]** key and enter the stop frequency for the next frequency band. Press the **[START FREQ]** key and enter the start frequency for the next frequency band. Repeat steps 3 through 8 until all DUT frequency bands have been tested up to 22 GHz (for HP 8340B), or 20 GHz (for HP 8341B).

4-8. SPURIOUS SIGNALS TEST, 22 to 26.5 GHz (Applies only to HP 8340B)

NOTE

Non-harmonically-related spurious responses, resulting from mixing products produced by two or more signals within the HP 8340B, follow a mathematical relationship to the signals that generated them. If the level of all such signals up to 22 GHz are within the specification, then no mixing products will be out of specification above 22 GHz. Therefore, no test is provided for non-harmonically-related spurious signals above 22 GHz.

Specification

Table 4-17. Spurious Signals Test (20 to 26.5 GHz) Specifications

SPURIOUS SIGNALS (Expressed in dB relative to the carrier level (dBc) at ALC level of 0 dBm)	**Bands and Approximate Frequency Ranges** (See Frequency Ranges and Bandswitch Points for complete description.)
	Band 4 **20 to 26.5 GHz**
Harmonics (up to maximum output frequency)	<−35
Subharmonics and multiples thereof (up to maximum output frequency)	<−20
Non-harmonically related spurious (CW and Manual Sweep mode only)	<−58
Power line related and spurious due to fan rotation within 5 Hz below line frequency, and multiples (CW mode only, all power levels)	
STANDARD INSTRUMENT	
Offset <300 Hz from carrier	<−38
Offset 300 Hz to 1 kHz from carrier	<−48
Offset >1 kHz from carrier	<−53

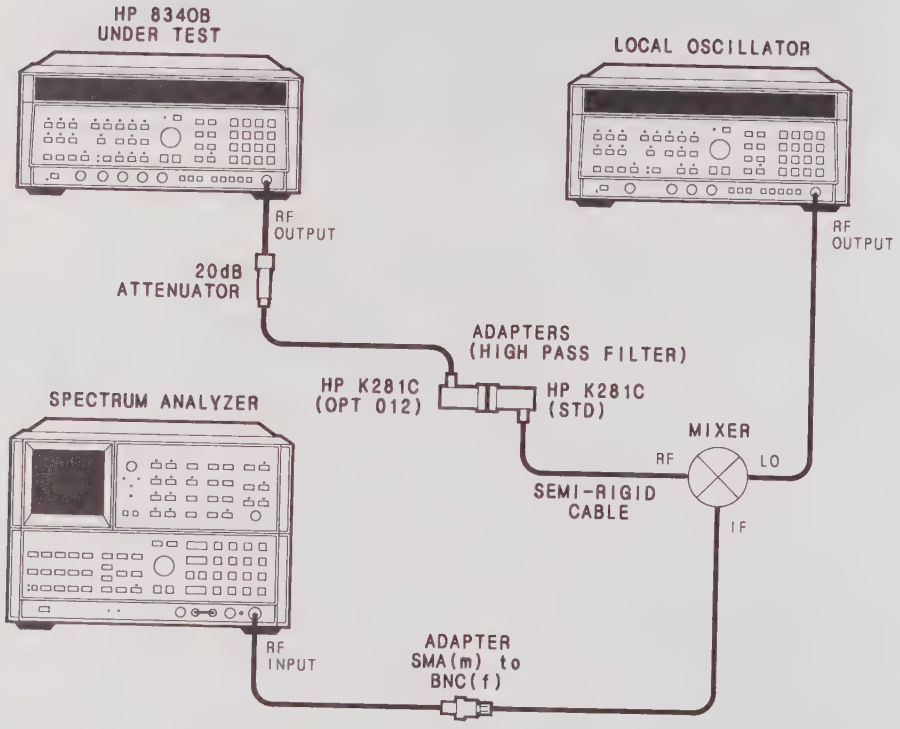


Figure 4-8. Spurious Signals Test Setup (22 to 26.5 GHz)

Description

The HP 8340B Under Test RF output signal is fed through a 20 dB pad and a high pass filter and is then down converted using a mixer and an HP 8340A/B as a Local Oscillator. the mixer output is fed to a low frequency spectrum analyzer.

The DUT is set to a CW frequency. All possible harmonics of the RF signal and harmonics of the YO frequency that could fall within the 22 GHz to 26.5 GHz range are determined.

The LO is set to a CW frequency 50 MHz below each harmonic. The specification is in dB below the carrier. To establish the carrier level at the IF, the DUT is temporarily set to the frequency of the harmonic and a reference level is established on the Spectrum Analyzer. The DUT is returned to the original CW frequency. The amplitude of the harmonic displayed on the Spectrum Analyzer is used to determine that the harmonic is at or below the specified level.

4-8. SPURIOUS SIGNALS TEST, 22 to 26.5 GHz (Applies only to HP 8340B) (Cont'd)

Equipment

Local Oscillator	HP 8340A/B Opt. 001
20 dB Attenuator	HP 8493C Opt 020
High Pass Filter (Made from the following adapters)[1]	
APC 3.5 (f) to Waveguide	HP K281C
APC 3.5 (m) to Waveguide	HP K281C Option 012
Mixer	HP P/N 0955-0307
Spectrum Analyzer	HP 3585A
Adapters	
SMA (m) to BNC (f)	HP P/N 1250-1200
Cable (Semi-Rigid SMA male to SMA male)	HP P/N 08340-20124

NOTE

It is important that the mixer be connected directly to the LO's RF Output connector. For best results in this test, the local oscillator drive to the mixer should be $\geq +4$ dBm.

Procedure

1. Connect equipment as shown in Figure 4-8. Allow at least a one hour warm up time. On the LO, press **[INSTR PRESET]** and **[PEAK]** (turns PEAK on).

2. Press the DUT's **[INSTR PRESET]** key. Press **[POWER LEVEL]**. If the power level in the ENTRY DISPLAY is not 0 dBm, enter **[0] [dBm]**. Press the **[CW]** key and enter any CW frequency in the 10 MHz to 26.5 GHz range.

3. Determine all possible harmonic frequencies of the RF signal that could fall within the 22 to 26.5 GHz range. Press **[SHIFT] [M2]** to display from left to right; the band number (in POWER dBm display) and the YO frequency. Determine all possible YO harmonic frequencies that could fall within the 22 to 26.5 GHz range.

4. Press the LO **[CW]** key and enter a frequency 50 MHz below the harmonic frequency to be tested. Press the **[POWER LEVEL]** key and, using the rotary knob, increase the power level until the UNLEVELED indicator light comes **ON**. Slowly decrease the power level until the UNLEVELED light just goes **OFF**.

5. Press **[SAVE] [1]** on the DUT to save the current instrument state. Press **[CW]** and enter the harmonic frequency to be tested. Set the Spectrum Analyzer to view the 50 MHz IF signal with the peak of the signal at the top graticule line.

6. Press **[RECALL] [1]** on the DUT to recall the original instrument state. The amplitude of the harmonic displayed on the Spectrum Analyzer should be at or below the specified test.

7. Repeat steps 4 through 6 for each harmonic frequency determined in step 3.

8. Set the DUT to another CW frequency and repeat steps 3 through 7.

---

1. The waveguide portions of these adapters pass high frequencies and attenuate low frequencies.

4-9. SINGLE SIDEBAND PHASE NOISE

Specification

Table 4-18. Single-sideband Phase Noise Specifications

SPURIOUS SIGNALS [Expressed in dB relative to the carrier level (dBc)]	**Bands and Approximate Frequency Ranges (GHz)** (see Frequency Ranges and Bandswitch Points for complete description)				
Single-sideband Phase Noise (dBc/1 Hz BW, CW Mode, all power levels)	**Band 0 0.01 to <2.3**	**Band 1 2.3 to <7.0**	**Band 2 7.0 to <13.5**	**Band 3 13.5 to <20.0**	**Band 4[1] 20.0 to 26.5**
Offset 30 Hz from carrier	< −64	< −64	< −58	< −54	< −52
Offset 100 Hz from carrier	< −70	< −70	< −64	< −60	< −58
Offset 1 kHz from carrier	< −78	< −78	< −72	< −68	< −66
Offset 10 kHz from carrier	< −86	< −86	< −80	< −76	< −74
Offset 100 kHz from carrier	< −107	< −107	< −101	< −97	< −95
OPTION 007, Relaxed Phase Noise Specifications					
Offset 100 Hz from carrier	< −67	< −67	< −61	< −57	< −55
Offset 1 kHz from carrier	< −75	< −75	< −69	< −65	< −63
Offset 10 kHz from carrier	< −83	< −83	< −77	< −73	< −71
Offset 100 kHz from carrier	< −107	< −107	< −101	< −97	< −95

1. Applies only to HP 8340B

Description

This test is performed in three steps: SYSTEM CALIBRATION, PHASE NOISE MEASUREMENT, and PHASE NOISE CALCULATION. A second HP 8340A/B or HP 8341A/B is used as a local oscillator (LO) to mix down the microwave frequency from the HP 8340B/41B under test (DUT) to a 1 MHz IF. The IF signal is amplified and, for 30 Hz, 100 Hz and 1 kHz offsets, sent directly to a low frequency spectrum analyzer (HP 3585A). For 10 kHz and 100 kHz offsets, a 1 MHz notch filter is inserted between the amplifier and the HP 3585A to attenuate IF signal and obtain increased dynamic range on the HP 3585A. Phase noise is measured using the OFFSET and NOISE LVL functions of the HP 3585A.

SYSTEM CALIBRATION obtains the system's frequency response data (Cal Data (CD) and IF Cal Data (IFCD), measured in dBc). A zero dBm, 1 MHz IF is established and then the LO frequency is reduced to obtain 1.00003, 1.0001, and 1.001 MHz IFs. At each point, the power level at the peak of the IF is recorded as the Cal Data (CD). A 1 MHz notch filter is then inserted between the amplifier and the HP 3585A. The LO frequency is again reduced to obtain 1.01 and 1.1 MHz IFs, and the Cal Data for these points is recorded. The LO frequency is then increased to obtain a 1 MHz IF and the response due to the 1 MHz notch filter is recorded as the IF Cal Data (IFCD). This data is required for calculating the actual phase noise for the 10 kHz and 100 kHz offsets. Since it is not required for the 30 Hz, 100 Hz and 1 kHz offsets, IFCD is defined as zero at these points.

4-9. SINGLE SIDEBAND PHASE NOISE (Cont'd)

PHASE NOISE MEASUREMENT obtains phase noise data for DUT frequencies of 2.202, 6.902, 13.402, 19.502, and, in the case of the HP 8340B, 26.032 GHz. These specific frequencies typically have the worst case phase noise for the HP 8340B/41B. The DUT is adjusted for the test frequency and then the LO frequency is adjusted to obtain a 1 MHz ± 0.9 Hz IF. A signal to noise level (IF to phase noise level at 30 Hz, 100 Hz, 1 kHz, 10 kHz, and 100 kHz offsets from IF) measurement is performed using the OFFSET and NOISE LVL functions of the HP 3585A and the results are recorded as the Measured Noise Level (MNL, measured in dBc).

PHASE NOISE CALCULATION takes the data obtained for MNL and adds and subtracts the calibration data and a 3 dB correction factor to obtain the actual phase noise. The formula that is used is:

$$\text{Actual Phase Noise} = \text{MNL} + \text{IFCD} - \text{CD} - 3\ \text{dB}$$

IFCD is the response of the 1 MHz notch filter at 1 MHz. Since the filter is not installed during the 10 Hz, 100 Hz and 1 kHz measurements, IFCD = 0. During the 10 kHz and 100 kHz offset measurements, the notch filter attenuates the IF causing the power difference between the IF and the phase noise to be smaller than it actually is, therefore IFCD must be added to MNL to correct this. The system's frequency response (LCD) causes the difference between the IF level and the phase noise level to be greater than it actually is, therefore CD must be subtracted from MNL. A factor of 3 dB is subtracted from MNL to correct for the LO's phase noise contribution.

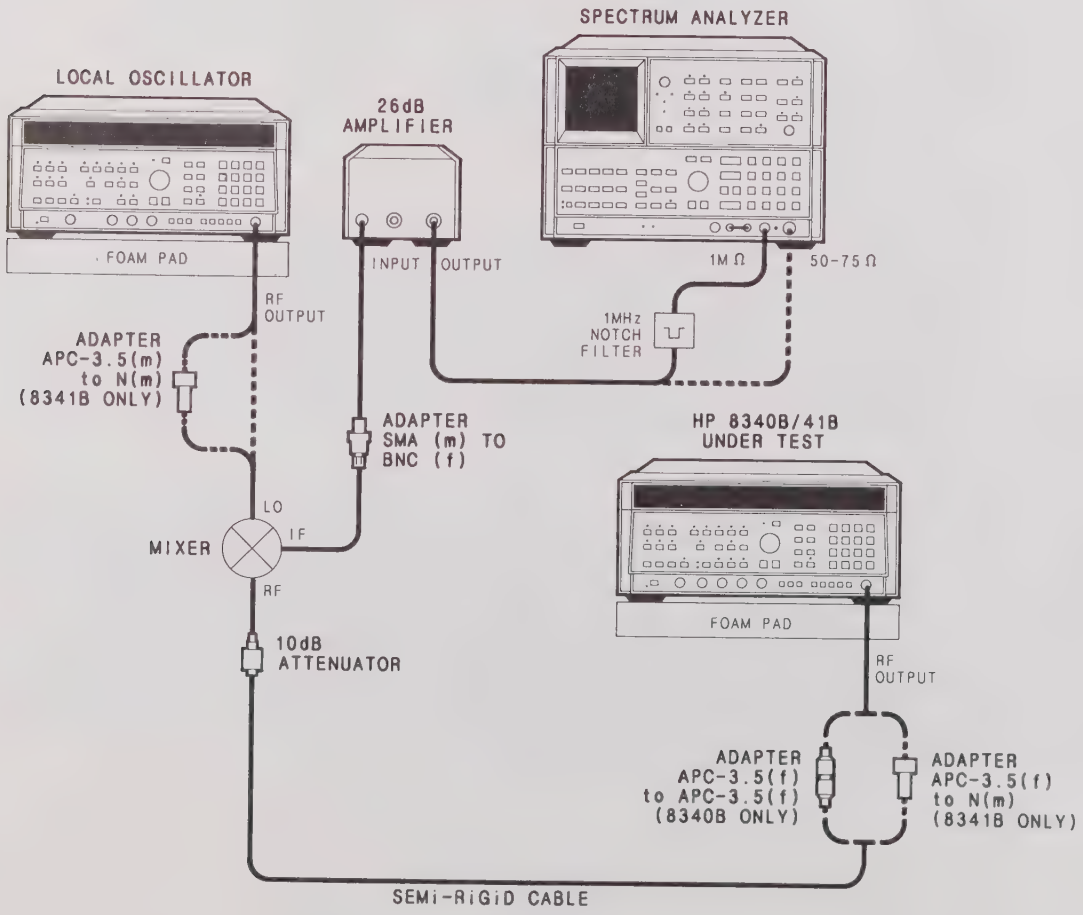


Figure 4-9. Single Sideband Phase Noise Test Setup

4-9. SINGLE SIDEBAND PHASE NOISE (Cont'd)

Equipment

Synthesized Sweeper (Local Oscillator) . . HP 8340A/B Opt. 001 or any HP 8341A/B[2]
Spectrum Analyzer . . . . . HP HP 3585A
Power Amplifier . . . . . HP 8447F
Attenuator . . . . . HP 8493C Opt. 010
Mixer . . . . . HP P/N 0955-0307
Adapters
  APC 3.5 (f) to APC 3.5 (f) . . . . . HP P/N 5061-5311
    (1 required if DUT is HP 8340B)
  Type N (m) to APC 3.5 (f) . . . . . HP P/N 1250-1744
    (1 required if DUT is HP 8341B)
  Type N (m) to APC 3.5 (m) . . . . . HP P/N 1250-1743
    (1 required if LO is HP 8341A/B)
  SMA (m) to BNC (f) . . . . . HP P/N 1250-1200
Cable (Semi-Rigid SMA male to SMA male) . . . . . HP P/N 08340-20124
Foam Pads . . . . . (Refer to note following step 1)
1 MHz Notch Filter . . . . . (See schematic in Recommended Test Equipment list, at the beginning of this section)

NOTE

It is important that the mixer be connected directly to the LO's RF Output connector.

Procedure

1. Connect equipment as shown in Figure 4-9 with the amplifier connected directly to the HP 3585A 50 Ohm input.

NOTE

The foam pads shown in Figure 4-9 are required to isolate the DUT and LO from mechanical vibrations which could induce phase noise.

NOTE

In this procedure, the LO is programmed for +10 dBm. At some points the LO may indicate an unleveled condition. This is to be expected and does not affect the phase noise measurement.

2. On the LO, press **[INSTR PRESET] [CW] [2] [.] [2] [0] [1] [GHz] [POWER LEVEL] [1] [0] [dB(m)] [PEAK]**.

3. On the DUT, press **[INSTR PRESET] [CW][2] [.] [2] [0] [2] [GHz] [POWER LEVEL] [0] [dB(m)] [PEAK]**.

4. On the HP 3585A, press INSTR PRESET, CENTER FREQUENCY, 1 MHz, FREQUENCY SPAN, 1 MHz.

5. Switch the HP 3585A AUTO RANGE and REF LVL TRACK off.

6. Allow the equipment to warm up for 1 hour.

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2. usable only with HP 8341B DUT.

4-9. SINGLE SIDEBAND PHASE NOISE (Cont'd)

7. Adjust the HP 3585A marker to the peak of the IF.

8. On the HP 3585A, press COUNTER.

9. Adjust the frequency of the LO for an HP 3585A COUNTER reading of 1 MHz ±0.9 Hz. This removes any frequency offsets between the DUT and LO.

10. Adjust the output power of the DUT for 0 dBm at the peak of the IF. Select a REFERENCE LEVEL of 0 dBm on the HP 3585A.

SYSTEM CALIBRATION

30 Hz Offset Calibration

(not applicable to units equipped with Option 007, Relaxed Phase Noise specifications)

11. On the HP 3585A, press FREQUENCY SPAN, 250 Hz, RES BW, 3 Hz. Allow one sweep to occur. Ensure power at peak if IF is still 0 dBm.

12. Reduce LO frequency by 30 Hz (IF = 1.00003 MHz ±0.9 Hz).

13. Allow one sweep of the HP 3585A to occur. Adjust the HP 3585A marker to the peak of the IF. Record the marker power level (Cal Data) into Table 4-19.

Table 4-19. Phase Noise Calibration Data

Step	Offset (Hz)	Cal Data (dB)
13	30	CD =
14	100	CD =
16	1K	CD =
19	10K	CD =
21	100K	CD =
22	0	IFDC =

100 Hz Offset Calibration

14. Reduce the LO frequency by 70 Hz (IF = 1.0001 MHz ±0.9 Hz) Repeat step 13.

1 kHz Offset Calibration

15. On the HP 3585A, press FREQUENCY SPAN, 2500 Hz, RES BW, 30 Hz.

16. Reduce LO frequency by 900 Hz (IF = 1.001 MHz ±0.9 Hz). Repeat step 13.

10 kHz Offset Calibration

17. Connect 1 MHz Notch Filter as shown in Figure 4-9. Select 1 MOhm input impedance on the HP 3585A.

18. On the HP 3585A, press FREQUENCY SPAN, 25 kHz, RES BW, 100 Hz.

19. Reduce LO frequency by 9 kHz (IF = 1.01 MHz ±0.9 Hz). Repeat step 13.

4-9. SINGLE SIDEBAND PHASE NOISE (Cont'd)

100 kHz Offset Calibration

20. On the HP 3585A, press FREQUENCY SPAN, 250 kHz, RES BW, 1 kHz.

21. Reduce LO frequency by 90 kHz (IF = 1.1 MHz ±0.9 Hz). Repeat step 13.

IF Cal Data

22. Increase the LO frequency by 100 kHz (IF = 1 MHz ±0.9 Hz). Repeat step 13.

PHASE NOISE MEASUREMENT

23. Connect equipment as shown in Figure 4-9 with the amplifier connected directly to the HP 3585A 50 Ohm input. Return the HP 3585A to 50 Ohm input impedance.

24. On the DUT, press **[POWER LEVEL] [0] [dB(m)]**. Select the HP 3585A REFERENCE LEVEL to place the peak of the IF at the top graticule of the display. Ensure IF = 1 MHz ±0.9 Hz. If necessary, adjust LO for an HP 3585A COUNTER reading of 1 MHz ±0.9 Hz.

25. On the HP 3585A, press FREQUENCY SPAN, 250 Hz, RES BW, 3 Hz. Step the RANGE until the overload light just turns on and then increment it one step. Allow one sweep to occur.

30 Hz Offset

(not applicable to units equipped with Option 007, Relaxed Phase Noise Specifications)

26. On the HP 3585A, press MANUAL, CLEAR A, MKR → CF, COUNTER.

27. On the HP 3585A, press OFFSET, ENTER OFFSET, CF STEP SIZE, 30 Hz, MANUAL, STEP UP (key), NOISE LVL. The noise level measurement takes approximately 30 seconds. For an accurate reading, allow at least 2 measurements to be made before recording value. Record Measured Noise Level (MNL) into Table 4-20.

Table 4-20. Phase Noise Measurement Data

Step	Offset	Measured Noise Level [MNL, dBc (1 Hz)]				
		2.202 GHz	6.902 GHz	13.402 GHz	19.502 GHz	26.032 GHz[1]
27	30					
29	100					
31	1K					
34	10K					
36	100K					

1. Applies only to HP 8340B

28. On the HP 3585A, press COUNTER, NOISE LVL, OFFSET, CONT. Return marker to peak of IF and ensure COUNTER reading is 1 MHz ±0.9 Hz. If necessary, adjust LO for a 1 MHz IF. If the IF drifted more than 6 Hz, steps 26 through 28 must be repeated.

4-9. SINGLE SIDEBAND PHASE NOISE (Cont'd)

100 Hz Offset

29. Repeat steps 26 through 28 with a CF STEP SIZE of 100 Hz substituted in step 27.

1 kHz Offset

30. On the HP 3585A, press FREQUENCY SPAN, 2.5 kHz, RES BW, 30 Hz.

31. Repeat steps 26 through 28 with a CF STEP SIZE of 1 kHz substituted in step 27.

10 kHz Offset

32. Connect the equipment in Figure 4-9 with the 1 MHz Notch Filter connected. Select the 1 MOhm input impedance on the HP 3585A.

33. On the HP 3585A, press FREQUENCY SPAN, 25 kHz, RES BW, 100 Hz. Decrement the RANGE until the overload light just turns on and then increment it one step.

34. Repeat steps 26 through 28 with a CF STEP SIZE of 10 kHz substituted in step 27.

100 kHz Offset

35. On the HP 3585A, press FREQUENCY SPAN, 250 kHz, RES BW, 1 kHz.

36. Repeat steps 26 through 28 with a CF STEP SIZE of 100 kHz substituted in step 27.

37. Repeat steps 23 through 36 for the CW frequencies shown in Table 4-21.

Table 4-21. Phase Noise Test Frequencies

CW Frequency (GHz)	
DUT	**LO**
6.902	6.901
13.402	13.401
19.502	19.501
26.032[1]	26.031[1]

1. Applies only to HP 8340B

4-9. SINGLE SIDEBAND PHASE NOISE (Cont'd)

PHASE NOISE CALCULATION

38. Using the data obtained in Table 4-19 and Table 4-20, calculate and enter the Actual Phase Noise into Table 4-21.

For example: Assume the following data was obtained for the 30 Hz offset at 26.032 GHz
CD = 0 dB (obtained in step 13)
MNL = −50.8 dB (obtained in step 27)
IFCD is defined to be 0 for a 30 Hz offset (also for 100 Hz and 1 kHz)
Therefore

$$\begin{aligned}\text{Actual Phase Noise} &= \text{MNL} + \text{IFCD} - \text{CD} - 3\ \text{dB} \\ &= -50.8 + 0 - 0 - 3 \\ &= -53.8\end{aligned}$$

The value −53.8 would be entered into Table 4-22.

For example: Assume the following data was obtained for the 10 kHz offset at 2.202 GHz
CD = −25.6 dB (obtained in step 19)
IFCD = −44.2 dB (obtained in step 22)
MNL = −66.0 dB (obtained in step 34)
Therefore

$$\begin{aligned}\text{Actual Phase Noise} &= \text{MNL} + \text{IFCD} - \text{CD} - 3\ \text{DB} \\ &= -66.0 + (-44.2) - (-25.6) - 3 \\ &= -87.6\end{aligned}$$

The value −87.6 would be entered into Table 4-22.

Table 4-22. Phase Noise Test Results

Actual[1] Single Sideband Phase Noise (dBc/1 Hz)					
Offset (Hz)	**2.202 GHz**	**6.902 GHz**	**13.402 GHz**	**19.502 GHz**	**26.032 GHz[2]**
30[3]					
100					
1K					
10K					
100K					

1. Actual = MNL + IFCD − CD − 3dB
   where IFCD = 0 for 30 Hz, 100 Hz, and 1 kHz offsets = value measured in step 22 (see Table 4-19) for 10K and 100 kHz offsets
2. Applies only to HP 8340B.
3. Not applicable to instruments equipped with Option 007, Relaxed Phase Noise Specifications.

4-10. POWER SWEEP TEST

Specification

Table 4-23. Power Sweep Test Specifications

Power Sweep

Range
Displayed: 0 to 40 dB/sweep
Actual: At least 10 dB at any given frequency (at least 20 dB in DECOUPLED mode); see Figure 2 in the HP 8340B/41B specification table.

Accuracy
Starting Power Level: Same as Output Power Accuracy
Power Sweep Width and Linearity: See Figure 2 in the HP 8340B/41B specification table.

In normal operation (a), the ALC does not operate below −9.95 dBm (see Figure 3 in the HP 8340B/41B specification table), and so the maximum power sweep range is the difference of −9.95 dBm and the maximum leveled power available at the frequency range of interest (specified leveled power shown in diagram). In the DECOUPLED mode (b), the power sweep range is extended because the ALC can operate down to −20 dBm.

Description

The DUT is set to allow the ALC and the step attenuator to be operated independently (**[SHIFT] [PWR SWP]**). The DUT is then set to do a 20 dB power sweep from −20 dBm to 0 dBm at a CW frequency. The DUT is set to do a manual sweep while its output power is measured at the two end points, −20 dBm and 0 dBm, using a power meter.

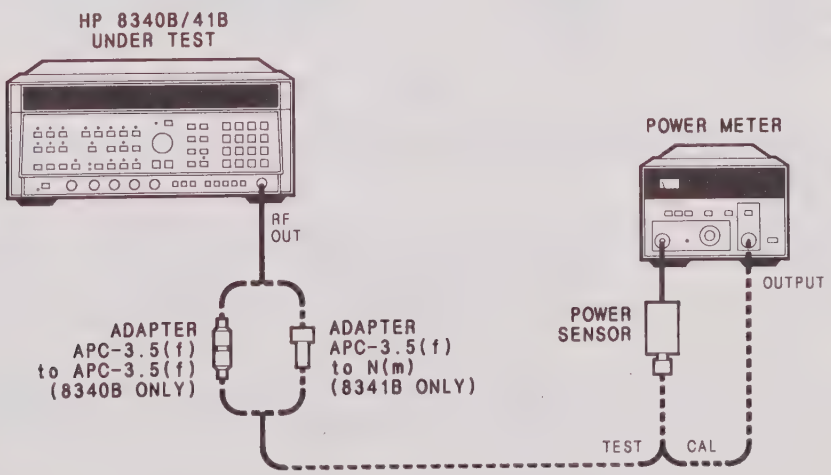

Figure 4-10. Power Sweep Test Setup

4-10. POWER SWEEP TEST (Cont'd)

Equipment

Power Meter ..... HP 436A Option 022
Power Sensor ..... HP 8485A
Adapters
APC 3.5 (f) to APC 3.5 (f) ..... HP P/N 5061-5311
(1 required if DUT is HP 8340B)
Type N (m) to APC 3.5 (f) ..... HP P/N 1250-1744
(1 required if DUT is HP 8341B)

Procedure

1. Connect equipment as shown in Figure 4-10. Connect the HP 8485A Power Sensor to the Power Meter. Allow a one hour warm up time. Set the Power Meter's calibration switch to include 1 GHz, then zero and calibrate the Power Meter before connecting the Power Sensor to the DUT.

2. Press the DUT's **[INSTR PRESET]**. Press the **[CW]** key and enter **[1] [GHz]**.

3. Press **[SHIFT] [PWR SWP]** to allow the ALC and RF step attenuator to be independently controlled.

NOTE

The step up and step down keys control the RF attenuator. The numeric key pad and rotary knob control the ALC power level.

4. Enter **[−] [2] [0] [dBm]** ALC Power level to set the start of the power sweep at −20 dBm. Press **[PWR SWP]** and enter **[2] [1] [dBm]** to set the power sweep range to >20 dB (The maximum power sweep range is from −20 dBm to maximum power).

5. Press the **[MANUAL]** key. Turn the rotary knob counterclockwise to find the beginning of the power sweep (i.e., the power meter indication is at maximum and no longer changing). Record the power meter indication.

NOTE

The POWER dBm display will indicate the approximate output power during a very slow or manual sweep.

6. Rotate the rotary knob clockwise to find the end of the power sweep (i.e., the power meter indication is at maximum and no longer changing). Record the power meter indication.

7. The difference between the power meter indications recorded in step 5 and step 6 must be ≥20 dB.

8. Press the **[CW]** key and enter **[5] [GHz]**. Set the power meter's calibration factor switch to include this frequency. Repeat steps 5 through 7 at CW frequencies of 10, 15, and, if the DUT is an HP 8340B, 26 GHz.

4-11. PULSE MODULATION ON/OFF RATIO TEST

NOTE

THIS TEST IS NOT APPLICABLE TO INSTRUMENTS EQUIPPED WITH OPTION 006, DELETE PULSE MODULATION

Specification

Table 4-24. Pulse Modulation ON/OFF Ratio Test Specifications

For CW mode and RF frequencies ≥400 MHz only:
On/Off Ratio: >80 dB

Description

The DUT under test is set to a CW frequency at 0 dBm. The RF output level is viewed on a spectrum analyzer. A reference level is set on the spectrum analyzer display, the PULSE key is pressed (ON).

NOTE

The 50 ohm termination on the DUT's PULSE input simulates the RF OFF state when PULSE is selected (ON).

The difference between the two spectrum analyzer displayed levels is the pulse ON/OFF ratio.

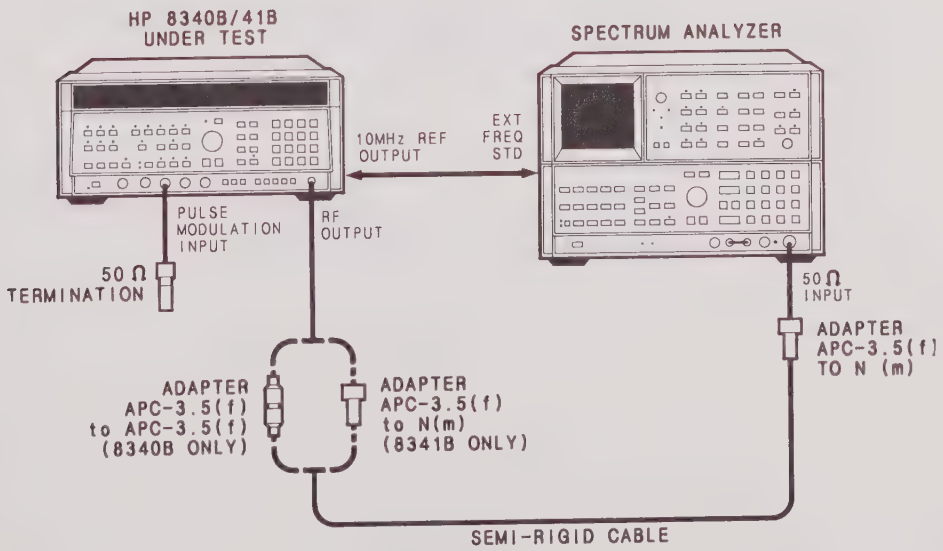

Figure 4-11. Pulse Modulation ON/OFF Ratio Test Setup

4-11. PULSE MODULATION ON / OFF RATIO TEST (Cont'd)

Equipment

Spectrum Analyzer	HP 8566B
50 Ohm Termination	HP 10100C
Adapters	
TYPE N (m) to APC 3.5 (f)	HP P/N 1250-1744
(2 required if DUT is HP 8341B)	
(1 required if DUT is HP 8340B)	
APC 3.5 (f) to APC 3.5 (f)	HP P/N 5061-5311
(1 required if DUT is HP 8340B)	
Cable SMA (m) to SMA (m)	HP P/N 08340-20124

Procedure

1. Connect equipment as shown in Figure 4-11. Allow a one hour warm up time.
2. On the DUT, press **[INSTR PRESET]** then **[CW] [1] [GHz]**. The RF power level should be 0 dBm.
3. Set the spectrum analyzer CENTER FREQUENCY to equal the DUT's CW frequency, FREQUENCY SPAN 200 Hz, RES BW 30 Hz, PEAK SEARCH, MKR → CF, MKR → REF LVL, MKRΔ.
4. Press the DUT's **[PULSE]** key (ON). The spectrum analyzer marker delta amplitude level should be greater than 80 dB.
5. Repeat steps 2 through 4 at CW frequencies of 3, 9, 15, and, if the DUT is an HP 8340B, 22 GHz.

NOTE

For further verification of the ON/OFF Ratio, steps 2 through 4 may be repeated for other frequencies of interest.

4-12. PULSE MODULATION RISE AND FALL TIME TEST

NOTE

THIS TEST IS NOT APPLICABLE TO INSTRUMENTS EQUIPPED WITH OPTION 006, DELETE PULSE MODULATION.

Specification

Table 4-25. Pulse Modulation Rise and Fall Time Test Specification

For CW mode and frequencies ≥400 MHz only:
Rise (T_R) and Fall (T_F) Times: <25 nanoseconds

Description

The DUT's RF output frequency is down converted to 50 MHz using a mixer and a local oscillator. The 50 MHz IF signal is amplified and applied to an oscilloscope. The DUT is pulsed using a pulse generator. The pulse generator output is also applied to the oscilloscope. The oscilloscope is used to measure the pulse envelope rise and fall times. Refer to Figure 4-12 Pulse Definitions.

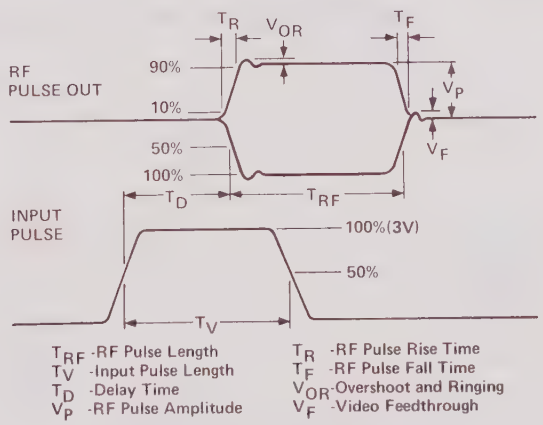

Figure 4-12. Pulse Definitions

4-12. PULSE MODULATION RISE AND FALL TIME TEST (Cont'd)

Equipment

Local Oscillator ..... HP 8340A/B Opt. 001 or any HP 8341A/B[1]
Pulse Generator ..... HP 8012B
Amplifier ..... HP 8447F
Oscilloscope ..... HP 1741A
Adapters
- APC 3.5 (f) to APC 3.5 (f) ..... HP P/N 5061-5311
  (1 required if DUT is HP 8340B)
- Type N (m) to APC 3.5 (f) ..... HP P/N 1250-1744
  (1 required if DUT is HP 8341B)
- Type N (m) to APC 3.5 (m) ..... HP P/N 1250-1743
  (1 required if LO is HP 8341A/B)
- SMA (m) to BNC (f) ..... HP P/N 1250-1200
- BNC Tee (m) (f) (f) ..... HP P/N 1250-0781

Cable (Semi-Rigid SMA male to SMA male) ..... HP P/N 08340-20124
10 dB Attenuator ..... HP 8493C Opt. 010
Mixer ..... HP P/N 0955-0307
Low Pass Filter (LPF) ..... HP P/N 9135-0260

NOTE

It is important that the mixer be connected directly to the LO's RF Output connector.

1. Usable only with HP 8341B DUT.

4-12. PULSE MODULATION RISE AND FALL TIME TEST (Cont'd)

Procedure

1. Connect equipment as shown in Figure 4-13. Connect the mixer directly to the local oscillator RF output to obtain maximum LO drive to the mixer. Connect the BNC tee directly to the HP 8340B/41B PULSE IN connector. Allow a one hour warm up time.

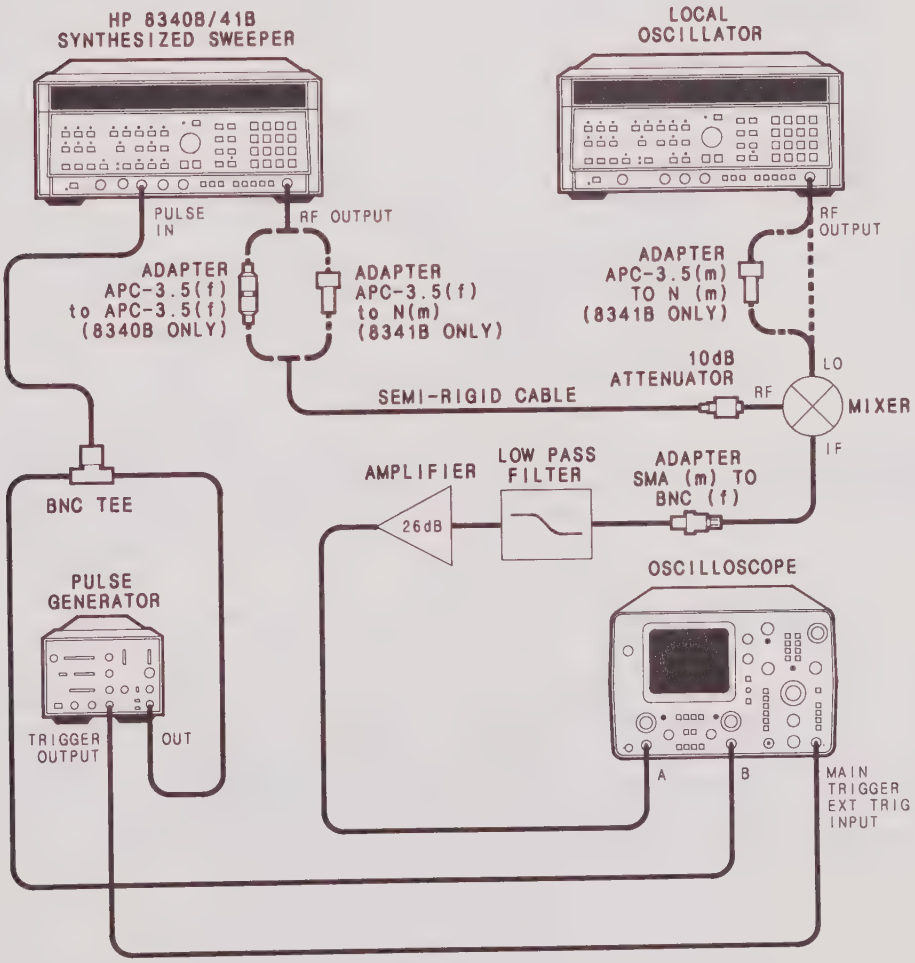

Figure 4-13. Pulse Modulation Rise and Fall Time Test Setup

4-12. PULSE MODULATION RISE AND FALL TIME (Cont'd)

2. Set up the HP 8012B Pulse Generator as follows:

OFFSET	OFF
POLARITY	+
OUTPUT	NORMAL
INT LOAD	IN
PULSE PERIOD slide switch	1μ–.1m
TRANSITION TIME slide switch	minimum (5n)
AMPLITUDE slide switch	top position (5.0)
PULSE DOUBLE/NORMAL	NORMAL
PULSE DELAY slide switch	minimum
Pulse Delay VERNIER	fully CCW
LEADING EDGE control	fully CCW
PULSE WIDTH slide switch	10n–1μ
TRAILING EDGE control	fully CCW

3. Set both oscilloscope channels A and B for 50 ohm input. Set the oscilloscope to view the pulse generator output waveform. Adjust the HP 8012B pulse width VERNIER for a 100 nanosecond pulse. Adjust the pulse period VERNIER for a 10 microsecond period.

   Adjust the amplitude VERNIER for about a 3V pulse amplitude (TTL level). Set the oscilloscope to trigger on this pulse (trigger on channel B).

4. Press **[INSTR PRESET]** on both the DUT and the LO. On the DUT, press **[CW] [1] [GHz]** and the **[PULSE]** modulation key. On the LO, press **[CW] [.] [9] [5] [GHz]**. The IF frequency is then 50 MHz. Set the LO for +10 dBm or maximum leveled output. The DUT's RF power should be 0 dBm.

   NOTE

   For best accuracy in this test, the Local Oscillator drive to the mixer should be ≥ +4 dBm.

5. Set the oscilloscope horizontal sweep to 50 nanoseconds/division and select channel A input only. Adjust the channel A (pulsed IF input signal) vertical gain and position so that the pulse OFF is at the 0% graticule line and the pulse ON is at 100% graticule line. Select the horizontal MAG X10. The oscilloscope is now calibrated for 5 nanoseconds/division. Adjust the horizontal position control to position the modulation envelope so that the 10% point of the envelope rise time is at the center vertical graticule line similar to Figure 4-14.

4-12. PULSE MODULATION RISE AND FALL TIME (Cont'd)

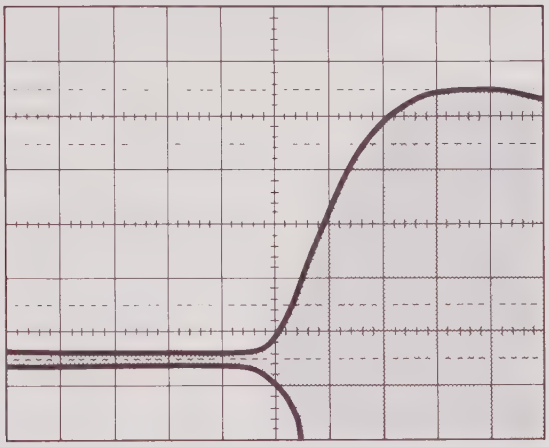

Figure 4-14. Pulse Modulation Rise Time Waveform

6. The 90% point of the envelope rise time should be less than 25 nanoseconds (5 horizontal divisions) from the 10% point.

7. Adjust the oscilloscope horizontal position control to view the modulation envelope fall time. Position the waveform so that the modulation envelope crosses the 90% graticule at a vertical graticule line similar to Figure 4-15.

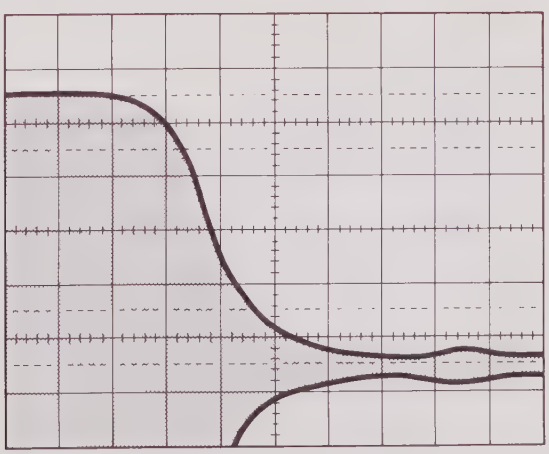

Figure 4-15. Pulse Modulation Fall Time Waveform

8. The 10% point should be <25 nanoseconds (5 divisions) from the 90% point.

9. Repeat steps 5 through 8 at CW frequencies of 3, 9, 15, and, if the DUT is an HP 8340B, 22 GHz. Set the LO CW frequency to be 50 MHz below the DUT's frequency.

4-13. PULSE MODULATION ACCURACY TEST

NOTE

THIS TEST IS NOT APPLICABLE TO INSTRUMENTS EQUIPPED WITH OPTION 006, DELETE PULSE MODULATION.

Specification

Table 4-26. Pulse Modulation Accuracy Test Specifications

For CW mode and frequencies ≥400 MHz only:

Minimum Internally Leveled RF Pulse Width (TI, RFI): 100 nanoseconds

Pulse Repetition Frequency:
Internally leveled: 100 Hz to 5 MHz

Accuracy of Internally Leveled RF Pulse VI, PI (relative to CW mode level):

NOTE

ALC attempts to hold pulse amplitude to same level as leveled CW signal.

Bands and Approximate Frequency Ranges (GHz)
(see Frequency Ranges and Bandswitch Points for complete description)

Pulse Width	Band 0 0.4 to <2.3	Bands 1 - 4[1] 2.3 to 26.5
100 to <200 ns	+3/−0.3 dB[2]	+1.5/−0.3 dB[2]
200 to <500 ns	+1.5/−0.3 dB[2]	±0.3 dB
≥500 ns	±0.3 dB	±0.3 dB

1. Band 4 (>20.0 to 26.5 GHz) only applies to the HP 8340B.
2. +15 to +55°C. Duty Cycle must be >0.01%

Description

The DUT's RF output frequency is down converted to 50 MHz using a mixer and a local oscillator. The 50 MHz IF signal is amplified and applied to an oscilloscope. The DUT is pulsed using a pulse generator. The IF modulation envelope is positioned to convenient horizontal graticule lines. The pulse is turned OFF and the DUT's output power level is adjusted so that the IF carrier is at the horizontal graticule lines established when the DUT was being pulsed. The change in DUT output power level is the accuracy error of the leveled RF pulse.

4-13. PULSE MODULATION ACCURACY TEST (Cont'd)

Equipment

Local Oscillator	HP 8340A/B Opt. 001 or any HP 8341A/B[3]
Pulse Generator	HP 8012B
Amplifier	HP 8447F
Oscilloscope	HP 1741A
Adapters	
APC 3.5 (f) to APC 3.5 (f) (1 required if DUT is HP 8340B)	HP P/N 5061-5311
Type N (m) to APC 3.5 (f) (1 required if DUT is HP HP 8341B)	HP P/N 1250-1744
Type N (m) to APC 3.5 (m) (1 required if LO is HP 8341A/B)	HP P/N 1250-1743
SMA (m) to BNC (f)	HP P/N 1250-1200
BNC Tee (m) (f) (f)	HP P/N 1250-0781
Cable (Semi-Rigid SMA male to SMA male)	HP P/N 08340-20124
10 dB Attenuator	HP 8493C Opt. 010
Mixer	HP P/N 0955-0307
Low Pass Filter (LPF)	HP P/N 9135-0260

NOTE

It is important that the mixer be connected directly to the LO's RF Output connector. For best accuracy in this test, the local oscillator drive to the mixer should be $\geq$ 4 dBm.

1. Connect equipment as shown in Figure 4-16. Connect the mixer directly to the LO's RF output connector to obtain the maximum mixer LO input level. Connect the BNC tee directly to the DUT's PULSE IN connector. Allow a one hour warm up.

2. Set up the 8012B Pulse Generator as follows:

PULSE PERIOD slide switch	1μ — .1m
TRANSITION TIME slide switch	minimum (5n)
AMPLITUDE slide switch	top position (5.0)
PULSE DOUBLE/NORMAL	NORMAL
PULSE DELAY slide switch	minimum
Pulse Delay VERNIER	fully CCW
LEADING EDGE control	fully CCW
PULSE WIDTH slide switch	10n-1μ
TRAILING EDGE control	fully CCW
OFFSET	OFF
POLARITY	+
OUTPUT	NORMAL
INT LOAD	IN

3. Set both oscilloscope channels (A and B) for 50 Ohm input. Set the oscilloscope to view the pulse generator output waveform. Adjust the 8012B pulse width VERNIER for a 100 nanosecond pulse. Adjust the pulse period VERNIER for a 10 microsecond period. Adjust the amplitude VERNIER for about a 3V pulse amplitude (TTL level).

---

3 Usable only with HP 8341B DUT.

4-13. PULSE MODULATION ACCURACY TEST (Cont'd)

4. Press **[INSTR PRESET]** on both the DUT and the LO. On the DUT, press **[CW] [1] [GHz] [POWER LEVEL] [−] [1] [0] [dBm]**. On the LO, press **[CW] [.] [9] [5] [GHz]**. The IF frequency is then 50 MHz. Set the LO for +10 dBm or maximum leveled output.

5. Set the oscilloscope horizontal for 50 nanoseconds/division and select channel A input only. Adjust the channel A (IF carrier input signal) vertical sensitivity to view the entire RF envelope.

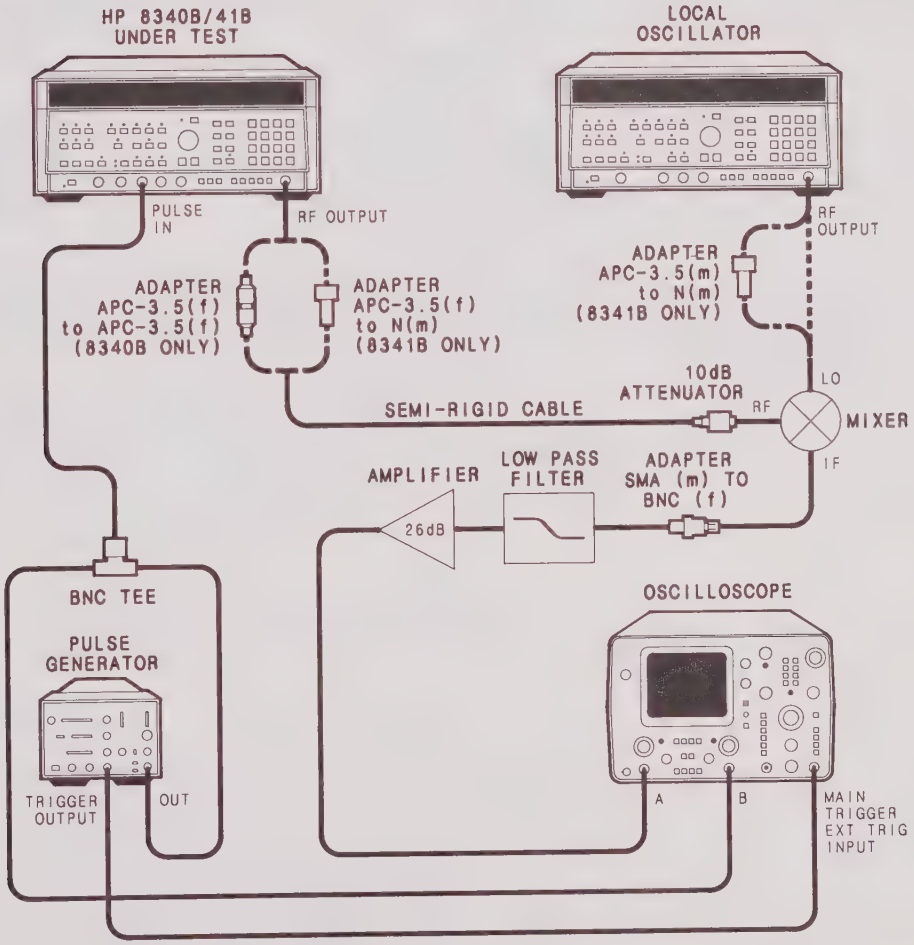

Figure 4-16. Pulse Modulation Accuracy Test

NOTE

It may be necessary to reduce the vertical sensitivity and/or adjust the DUT's RF output level at some frequencies.

4-13. PULSE MODULATION ACCURACY TEST (Cont'd)

6. Press the **[PULSE]** key on the DUT (pulse ON). Adjust the oscilloscope vertical position and sensitivity to place the modulation envelope on convenient horizontal graticule lines. Press the **[PULSE]** key to turn pulse OFF. Press the **[POWER LEVEL]** key on the DUT. Note the power level in the **ENTRY DISPLAY**.

7. Adjust the DUT's power level using the rotary knob so that the IF carrier signal aligns with the horizontal graticule lines established in step 6 for the modulation envelope. Note the **ENTRY DISPLAY** power level.

8. The difference between the power levels noted in step 6 and 7 should be less than the specification for this pulse width and RF frequency.

9. Repeat steps 5 through 8 for pulse widths of 200, 500, and 1000 nanoseconds.

10. To test the Pulse Repetition Frequency range (100 Hz to 5 MHz), set the pulse generator period to 10 milliseconds (100 Hz) and pulse width to 1 microsecond (duty cycle of 0.01%). Repeat steps 5 through 8. Set the pulse generator period to 200 nanoseconds (5 MHz) and pulse width to 100 nanoseconds (minimum specified PW). Repeat steps 5 through 8.

11. Set the pulse generator period to 10 microseconds and pulse width to 100 nanoseconds. Repeat steps 5 through 10 at CW frequencies of 3, 9, 15, and, if the DUT is an HP 8340B, 22 GHz. Set the LO's CW frequency to be 50 MHz below the DUT's frequency. For DUT frequencies of 15 and 22 GHz, press **[PEAK]** to ON.

4-14. PULSE MODULATION VIDEO FEEDTHROUGH TEST

NOTE

THIS TEST IS NOT APPLICABLE TO INSTRUMENTS EQUIPPED WITH OPTION 006, DELETE PULSE MODULATION

Specification

Table 4-27. Pulse Modulation Video Feedthrough Test Specification

For CW mode and frequencies only:
Video Feedthrough (V_F/V_P):
0.4 <2.3 GHz (Band 0): <5% for output power levels ≤+8 dBm
2.3 to 26.5 GHz (Bands 1-4)[1]: ≤0.2%

1. Band 4 (>20.0 to 26.5 GHz) only applies to the HP 8340B.

Description

NOTE

Video feedthrough is any component of the pulse generator signal that appears at the DUT's RF output connector.

The DUT is set to a CW frequency at 0 dBm and is pulsed using a pulse generator. The pulsed RF output signal is fed through a 10 dB attenuator and a low pass filter that will pass only the low frequency (video feedthrough) component of the modulation envelope. The video feedthrough is measured using an oscilloscope. The measured voltage is related to the RF power by:

$P = 10 \log (V^2/R/1\ mW)$

Where:

P = DUT RF output level minus 10 dB, and

R = 50 Ohms.

Equipment

Pulse Generator	HP 8012B
Oscilloscope	HP 1741A
Adapters	
APC 3.5 (f) to APC 3.5 (f) (1 required if DUT is HP 8340B)	HP/PN 5061-5311
Type N (m) to APC 3.5 (f) (1 required if DUT is HP 8341B)	HP P/N 1250-1744
SMA (m) to BNC (f)	HP P/N 1250-1200
BNC Tee (m) (f) (f)	HP P/N 1250-0781
10 dB Attenuator	HP 8493C Opt. 010
Low Pass Filter (LPF)	HP P/N 9135-0260

Procedure

1. Connect equipment as shown in Figure 4-17. Attach the BNC tee directly to the DUT's PULSE input connector. Allow a one hour warm up time.

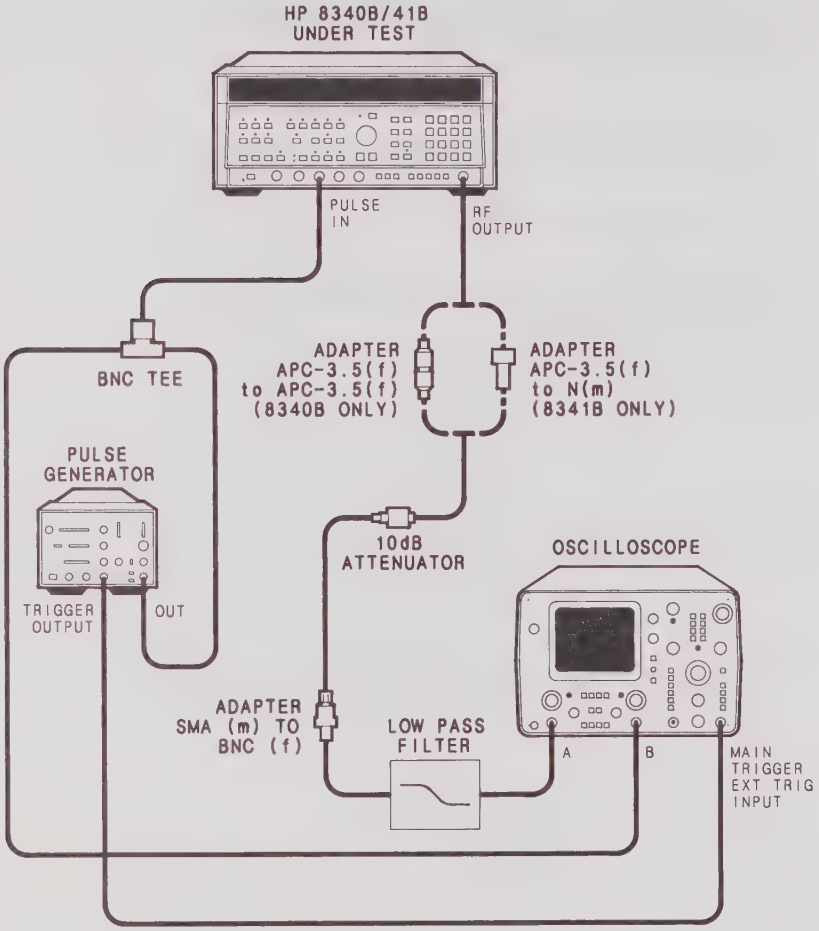

Figure 4-17. Pulse Modulation Video Feedthrough Test Setup

2. Set up the HP 8012B Pulse Generator at follows:

PULSE PERIOD slide switch ..... 1μ – .1m
TRANSITION TIME slide switch ..... minimum (5n)
AMPLITUDE slide switch ..... top position (5.0)
PULSE DOUBLE/NORMAL ..... NORMAL
PULSE DELAY slide switch ..... minimum
Pulse Delay VERNIER fully ..... CCW
LEADING EDGE control ..... fully CCW
PULSE WIDTH slide switch ..... 10n - 1μ
TRAILING EDGE control ..... fully CCW
OFFSET ..... OFF
POLARITY ..... +
OUTPUT ..... NORMAL
INT LOAD ..... IN

4-14. PULSE MODULATION VIDEO FEEDTHROUGH TEST (Cont'd)

3. Set both oscilloscope channels (A and B) to 50 Ohm input. Set the oscilloscope to view the pulse generator output waveform. Adjust the HP 8012B pulse width VERNIER for a 100 nanosecond pulse. Adjust the pulse period VERNIER for a 100 microsecond period. Adjust the amplitude VERNIER for about a 3V pulse amplitude (TTL level). Set the oscilloscope horizontal sweep to 50 nanoseconds/division and select channel A input only.

4. On the DUT, press **[INSTR PRESET]** followed by **[CW] [.] [4] [GHz]**. Press the **[PULSE]** key (pulse ON).

5. Press the **[POWER LEVEL]** key and enter the first power level, **[8] [dBm]**.

6. Adjust the oscilloscope channel A vertical sensitivity and vertical position to view the video feedthrough signal similar to Figure 4-18.

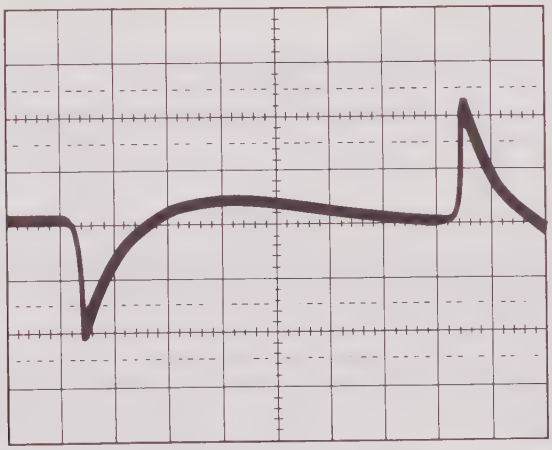

Figure 4-18. Pulse Modulation Video Feedthrough Waveform

7. The test limits for the three power levels are shown in Table 4-28. (Note that the test limit is 5% of Vpk.)

Table 4-28. Pulse Modulation Video Feedthrough Test Limits

HP 8340B/41B RF Output Level (dBm)	P = (dBm)	Vpk	TEST LIMIT (pk voltage)
+8	−2	0.2511	12 mV
0	−10	0.0999	5 mV
−10	−20	0.03162	1.6 mV

The test limits are derived using the following equation:

$P = 10 \log (Vrms^2/R/1\ mW)$

Where:

P = DUT RF output level −10 dBm, and,

R = 50 Ohms.

Example:

For a DUT set to 0 dBm, the output of the 10 dB pad is −10 dBm.

$P = 10 \log (Vrms^2/R/1\ mW)$

$-10 = 10 \log (V^2/50/0.001)$ (divide through by 10)

$-1 = \log (V^2/50/0.001)$ take antilog of both sides

$10^{-1} = 0.1 = (V^2/50/0.001)$ (cross multiply)

$0.0001 = V^2/50$ (cross multiply again)

$\sqrt{0.005} = V = 0.0707$ rms

Test Limit = Vpk × 5% = 0.0707 × 1.414 × 5% = 5 mV

8. Repeat steps 6 and 7 for DUT output power levels of 0 and −10 dBm.
9. Repeat steps 5 through 8 at CW frequencies of 1, 1.5, and 2 GHz.

NOTE

For DUT frequencies above 2.3 GHz the video feedthrough is typically so small that it is difficult to measure. The following steps provide a means to verify that the video feedthrough is negligible.

10. Remove the 10 dB pad between the DUT and the low pass filter. Press the **[CW]** key and enter any frequency from >2.3 GHz to the DUT's maximum frequency. Press the **[POWER LEVEL]** key and enter **[−] [1] [0] [dBm]**.
11. Select the oscilloscope X5 vertical magnifier. The test limit is now 0.2 mV or 1 minor division on the oscilloscope.
12. Select several CW frequencies >2.3 GHz. and verify that the video feedthrough is less than 1 minor division on the oscilloscope.

4-15. AMPLITUDE MODULATION TEST

Specification

Table 4-29. Amplitude Modulation Test Specifications

The following specifications apply when the HP 8340B/41B are internally leveled, for waveforms whose envelope peak is at least 1 dB below maximum specified power. Unless noted, pulse modulation must be OFF; however, the HP 8340B/41B are capable of simultaneous amplitude and pulse modulation. See Section III, Operation.

AM Depth: 0 to 90%

AM Sensitivity at 1 kHz rate and 30% depth: 100%/Volt ± 5%

AM Bandwidth relative to a 1 kHz rate at 30% depth: DC coupled, 3 dB point ≥ 100 kHz

AM Frequency Response (Flatness) Relative to a 1 kHz rate at 30% depth, DC to 10 kHz: ±0.20 dB

Description

AM sensitivity and accuracy is determined by simulating a modulation signal (i.e., setting the function generator to a dc voltage). The unmodulated DUT RF output is measured using a power meter. A dc voltage representing ±30% modulation (±0.3 Vdc) is applied to the DUT's AM input. The power meter indication should change by:

20 log (1 + (dc voltage ± (0.05 times the dc voltage)))

The sensitivity and accuracy is tested at several CW frequencies.

The AM frequency response and bandwidth is measured by down converting the DUT's RF frequency to an IF frequency within the range of the modulation analyzer. The DUT is amplitude modulated using a function generator. The modulation analyzer is set to indicate 0 dB at the reference modulation frequency of 1 kHz. The modulation frequency is varied and the flatness is indicated on the modulation analyzer. The modulating frequency is then set to the bandwidth specification (100 kHz) and the modulation analyzer should indicate > −3 dB. This shows that the actual 3 dB point will occur at a frequency >100 kHz.

Finally, the function generator output level is increased to obtain >90% modulation depth.

Equipment

Local Oscillator	HP 8340A Opt. 001 or any HP 8341A/B[1]
Modulation Analyzer	HP 8901A
Function Generator	HP 3325A
Digital Voltmeter	HP 3455A
Amplifier	HP 8447F
Power Meter	HP 436A
Power Sensor	HP 8485A

1. Usable only with HP 8341B DUT.

Equipment, Cont'd

Adapters
- APC 3.5 (f) to APC 3.5 (f) ..... HP P/N 5061-5311
  (1 required if DUT is HP 8340B)
- Type N (m) to APC 3.5 (f) ..... HP P/N 1250-1744
  (1 required if DUT is HP HP 8341B)
- Type N (m) to APC 3.5 (m) ..... HP P/N 1250-1743
  (1 required if LO is HP 8341A/B)
- Type N (m) to BNC (f) ..... HP P/N 1250-1476
- SMA (m) to BNC (f) ..... HP P/N 1250-1200
- BNC Tee (m) (f) (f) ..... HP P/N 1250-0781

Cable (Semi-Rigid SMA male to SMA male) ..... HP P/N 08340-20124
20 dB Attenuator ..... HP 8493C Opt. 020
Mixer ..... HP P/N 0955-0307

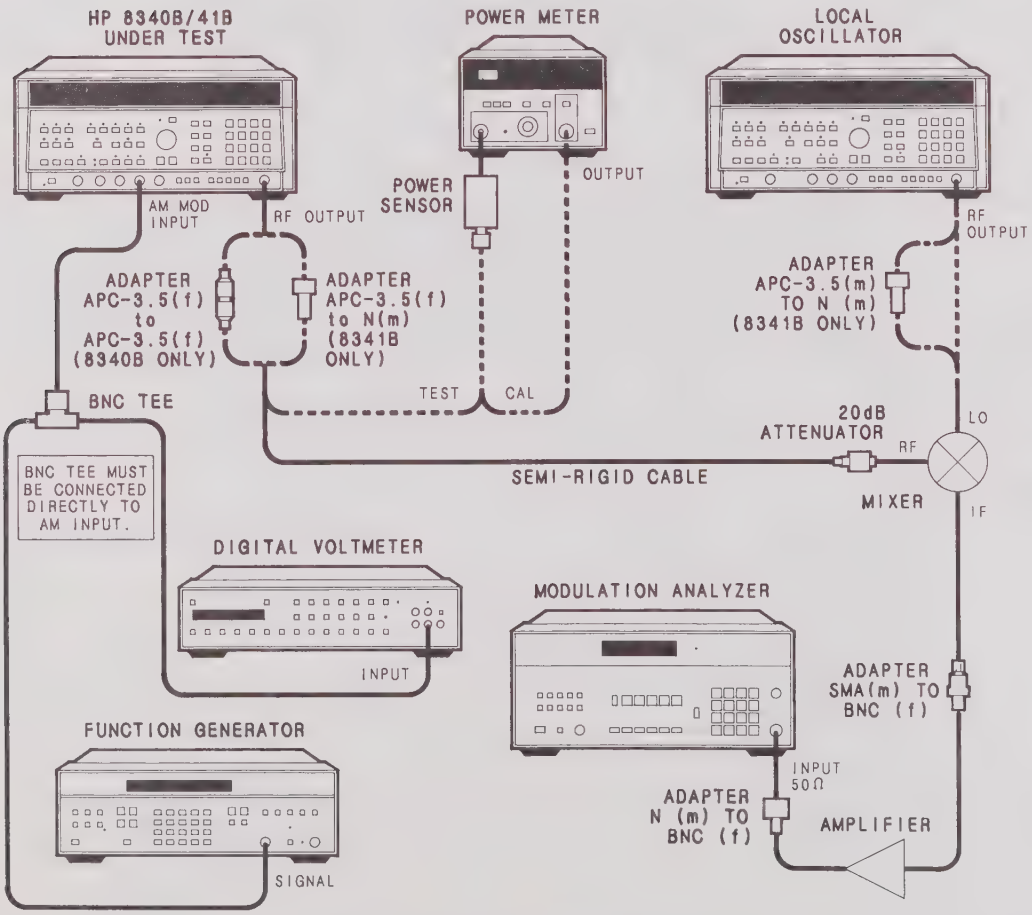

Figure 4-19. Amplitude Modulation Test Setup

4-15. AMPLITUDE MODULATION TEST (Cont'd)

NOTE

It is important that the mixer be connected directly to the LO's RF Output connector.

Procedure

AM SENSITIVITY AND ACCURACY

1. Connect equipment as shown in Figure 4-19. Connect the mixer LO port at the LO's RF output. Connect the Power Sensor to the power meter. Allow a one hour warm up time. Set the power meter's calibration factor switch to include 1.5 GHz, then zero and calibrate the power meter. Connect the power sensor to the DUT's RF output.

2. On the DUT, press **[INSTR PRESET] [CW] [1] [.] [5] [GHz]**. Press the **[POWER LEVEL]** key and enter **[−] [5] [dBm]**.

NOTE

The function generator output impedance is 50 Ohms and its output indication accuracy assumes a 50 Ohm load. The DUT's AM input impedance is 600 Ohms; therefore, a high impedance DVM is used to measure and set the function generator output level.

3. Zero the power meter as follows:

   With power applied to the sensor, press the power meter RANGE HOLD. Press the DUT's **[RF]** key to turn the RF OFF. Zero the power meter. Press the **[RF]** key to turn the RF ON.

4. Using the DVM as an indicator, set the function generator to output 0 Vdc (If the function generator being used does not have this feature, use a dc power supply). Press the DUT's **[AM]** key (AM ON). Note the power meter indication.

5. Simulate +30% modulation by setting the function generator output to +0.3 volts dc as indicated on the DVM. The power meter indication should increase by 2.18 to 2.38 dB from the value noted in step 4.

   20 log (1 + (0.3 − (0.05 times 0.3))) = 2.18 dB

   to

   20 log (1 + (0.3 + (0.05 times 0.3))) = 2.38 dB

6. Simulate −30% modulation by setting the function generator output to −0.3 volts dc as indicated on the DVM. The power meter should decrease by 2.91 to 3.29 dB from the value noted in step 4.

   20 log (1 + (−0.3 − (0.05 times −0.3))) = −2.91 dB

   to

   20 log (1 + (−0.3 + (0.05 times −0.3))) = −3.29 dB

NOTE

The DUT's test power levels are selected to avoid power meter range changes at the +30 and −30% modulation settings.

4-15. AMPLITUDE MODULATION TEST (Cont'd)

7. Press the DUT's **[POWER LEVEL]** key and enter **[+] [5] [dBm]**. Press the **[AM]** key to turn AM OFF. Repeat steps 3 through 6 for this power setting.

8. Press the DUT's **[CW]** key and enter **[4] [.] [5] [GHz]**. Press the **[AM]** key to turn AM OFF. Set the power meter's calibration factor switch to include 4.5 GHz. Repeat steps 3 through 6 for DUT power settings of −5 and +5 dBm.

AM FREQUENCY RESPONSE AND BANDWIDTH

9. Disconnect the power sensor and connect the DUT's RF output to the 20 dB attenuator.

10. On the DUT, press **[CW] [1] [.] [5] [GHz]**, **[POWER LEVEL] [0] [dBm]**. On the LO, press [INSTR PRESET] [CW] [1] [.] [4] [5] [GHz], [POWER LEVEL] [1] [0] [dBm]. Press PEAK (ON). (The output may be unleveled; this will not affect the test.) The IF frequency is now 50 MHz.

NOTE

For best accuracy in the Amplitude Modulation test, the Local Oscillator drive to the mixer should be > +4 dBm.

11. Set the function generator for a sine wave at a reference frequency of 1 kHz at 0.2121 Vrms (0.3 times 0.707) ±0.05 Vrms. For example: 0.25 Vrms, as indicated on the DVM, would fall in this range. Set the modulation analyzer input frequency to 50 MHz (by pressing FREQ 50 MHz), then press AM and AVE. The modulation analyzer should indicate about 21%. Note the DVM indication.

12. Press the dB key. As the modulating frequency is changed, the modulation analyzer will indicate the flatness in dB relative to the 1 kHz reference.

13. Set the function generator to 100, 200, 500 Hz, then 1, 2, 5, and 10 kHz. Check the DVM indication and adjust the level of the modulating signal at each frequency to eliminate any flatness error of the function generator. Observe the flatness indication on the modulation analyzer. The flatness indication should be ≤ ±0.20 dB.

14. Check the AM bandwidth by setting the function generator to 100 kHz. Adjust the function generator output level to the value noted in step 11. The modulation analyzer should indicate ≥ −3 dB.

AM DEPTH

15. Set the function generator to 1 kHz. Set the modulation analyzer to indicate percent modulation by setting the controls as follows:

AUTOMATIC OPERATION	ON
AM	ON
RATIO %	OFF
RATIO dB	OFF
PEAK	+

Increase the function generator output amplitude to obtain >90% modulation depth.

16. Repeat steps 11 through 15 at DUT RF frequencies of 3, 9, 15, and, if the DUT is an HP 8340B, 22 GHz. Make sure LO CW frequency is always 50 MHz below the DUT frequency.

4-16. FM ACCURACY AND FLATNESS

Specification

Table 4-30. Frequency Modulation Specifications

FREQUENCY MODULATION	
Modulation Rate: 50 kHz to 10 MHz (3 dB Bandwidth)	
Peak Deviation:	
Bands 0,1:	The lesser of 10 MHz or 5 x modulation rate
Band 2:	The lesser of 10 MHz or 10 x modulation rate
Band 3:	The lesser of 10 MHz or 15 x modulation rate
Band 4[1]:	The lesser of 10 MHz or 20 x modulation rate
Deviation Accuracy (at 100 kHz rate): ±10%	
Sensitivity: 1 MHz/V and 10 MHz/V	

1. Band 4 only applies to the HP 8340B.

FM Accuracy Description

FM Accuracy is measured by observing the modulated RF carrier on a spectrum analyzer. When the modulation index (Peak Deviation divided by Modulation Rate) is set to exactly 2.404, the power in the carrier will be at zero. This is called a Bessel Null.

Once the carrier has been nulled, the Peak Deviation is known precisely since the Modulation Rate is synthesized. Since the Peak Deviation is known, the FM input voltage can be measured to calculate the FM input sensitivity (1 or 10 MHz/V nominally). The error from nominal is expressed as a percent and is the FM accuracy. This is measured at a 100 kHz rate.

Equipment

Spectrum Analyzer ..... HP 8566B
Digital Voltmeter ..... HP 3456A
Function Generator ..... HP 3325A
Adapters:
- APC 3.5(f) to TYPE N(m) ..... HP P/N 1250-1744
  (1 required if DUT is HP 8340B) (2 required if DUT is HP 8341B)
- APC 3.5 (f) to APC 3.5 (f) ..... HP P/N 5061-5311
  (1 required if DUT is HP 8340B)
- BNC(f) to dual banana ..... HP P/N 1251-2277
- BNC Tee (m) (f) (f) ..... HP P/N 1250-0781

Cables:
- Semi-Rigid, (SMA male to SMA male) ..... HP P/N 08340-20124
- BNC (m) to BNC (m) (2 required) ..... HP P/N 8120-8140

4-16. FM ACCURACY AND FLATNESS (Cont'd)

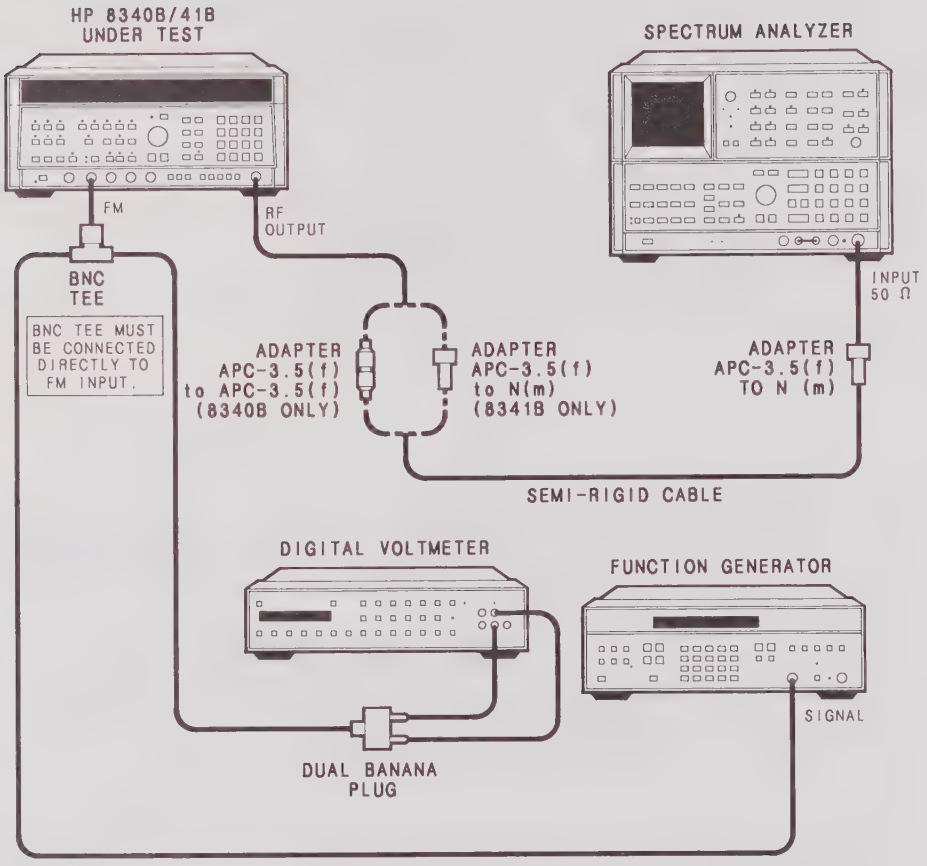

Figure 4-20. FM Accuracy Setup

Procedure

1. Connect the equipment as shown in Figure 4-20, FM Accuracy Setup. The BNC Tee should be connected directly to the DUT's FM input BNC.

2. Set the function generator to a 100 kHz sine wave. Set the DVM to ac volts.

3. Press **[INSTR PRESET]** on the DUT and set up the following conditions:

Sweep Mode:	CW
Frequency out:	2.2 GHz
Leveling:	INT
RF Output:	0 dBm
RF Peaking (PEAK):	ON
FM	ON
FM Sensitivity:	1 MHz/V (default condition)

4-16. FM ACCURACY AND FLATNESS (Cont'd)

4. On the function generator, press AMPTD 450 mV (p-p). Then press the **LEFT ARROW** key until the first digit on the left side of the decimal point is flashing.

5. Set the spectrum analyzer's center frequency to that of the DUT. Choose a frequency span of 2 MHz. Observe the carrier on the display of the spectrum analyzer while performing step 6.

6. Press the function generator's **UP ARROW** or **DOWN ARROW** keys until the carrier is nulled (minimum amplitude). The function generator's **LEFT ARROW** and **RIGHT ARROW** keys will change the resolution of the **UP ARROW** and **DOWN ARROW** keys for a finer or coarser amplitude adjustment.

7. Measure the rms amplitude of the FM input with the DVM. Note this value on the test record card as V_{in}.

   Calculate the actual FM sensitivity and then the percent error. Actual deviation is equal to 2.404 times 100 kHz (since the modulation index is at the first Bessel Null). The actual FM sensitivity is then:

   Actual FM Sensitivity = $(.2404)/(V_{in} \times 1.414)$

   % Error = 100 x (Actual FM Sensitivity − Range)/Range
   Where "Range" = 1 (for 1 MHz/V), or 10 (for 10 MHz/V).

8. Set the function generator's amplitude to 45 mV p-p. Press the DUT's the **UP ARROW** key to select an FM sensitivity of 10 MHz/V. Repeat steps 6 and 7.

9. Repeat steps 4 through 8 at CW frequencies of 2.5, 6.9, 13.4, 18 and 20 GHz (20 GHz applies to the 8340B only). After entering a new CW frequency, press the FM key twice to display the FM sensitivity in the DUT's ENTRY DISPLAY and then press the DUT's **DOWN ARROW** key to select an FM sensitivity of 1 MHz/V.

4-16. FM ACCURACY AND FLATNESS (Cont'd)

FM Flatness Description

The FM Flatness test uses a delay line discriminator. The discriminator is formed by driving a mixer with a modulated carrier into the LO port, and a delayed carrier into the RF port. The delay is produced with a 3 foot length of cable (the length does not have to be precise). When connected like this, the mixer responds to phase differences between its two inputs. The cable exhibits a constant time delay. As the carrier frequency changes, the cable causes a phase shift at the mixer inputs. This phase shift varies linearly with frequency. The mixer only operates as a phase detector when its inputs are 90° out of phase relative to one another (quadrature). A carrier frequency must chosen such that the cable delay causes a phase shift of 90° (this will be explained in the procedure).

The output of the discriminator is fed to the 50 Ohm input of an HP 3585A spectrum analyzer. By using the tracking generator output to drive the FM input of the DUT, a swept response of FM Flatness will be seen on the spectrum analyzer CRT. The response relative to 100 kHz is verified against the specification.

This test also checks control circuitry on the A23 FM Driver assembly. (That is why FM is checked in bands other than the fundamental band of the YIG oscillator).

Equipment

Spectrum Analyzer	HP 3585A
Mixer	HP P/N 0955-0307
Power Amplifier	HP 8447F
Power Splitter	HP 11667B
Step Attenuator	HP 355D
Delay Line (> 1 meter in length)	HP P/N 08503-20038
Adapters:	
APC 3.5 (m) to APC 3.5 (m)	HP P/N 1250-1748
SMA (m) to BNC (f)	HP P/N 1250-1200
Cables:	
Semi-Rigid, SMA (m) to SMA (m)	HP P/N 08340-20124
BNC (m) to BNC (m) (4 required)	HP P/N 8120-8140

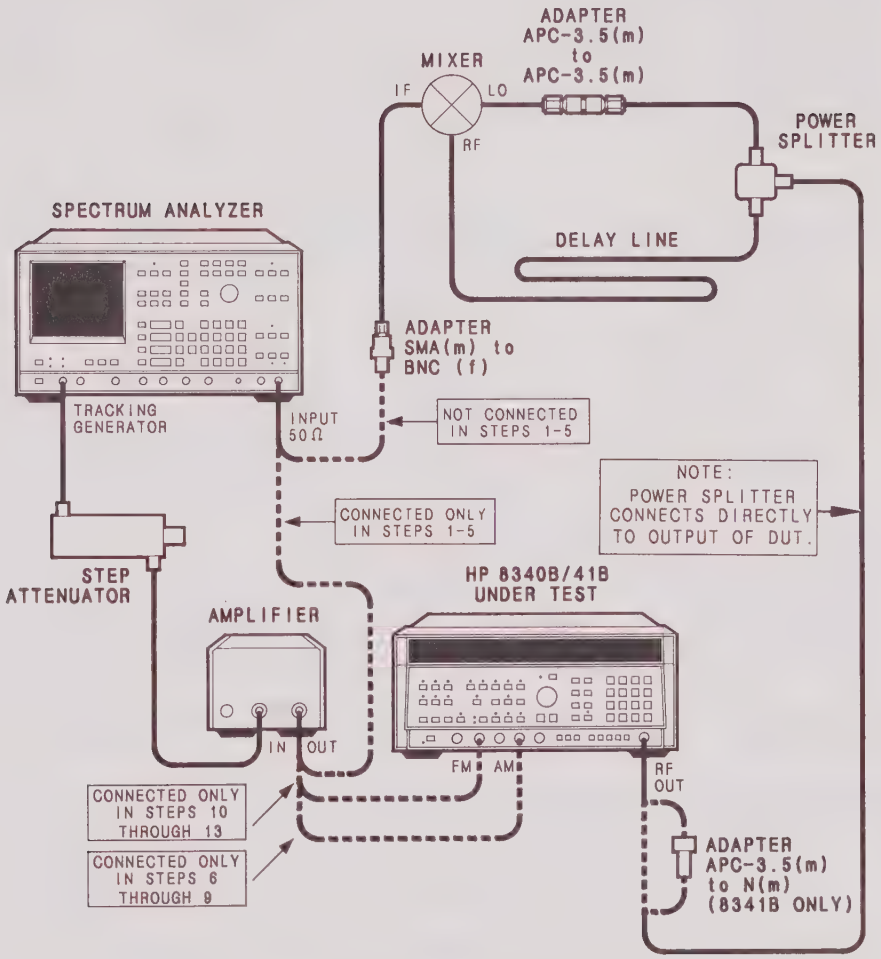

Figure 4-21. FM Flatness Setup

Procedure

1. Refer to Figure 4-21, FM Flatness Setup. Connect the test equipment as shown. Connect the output of the HP 8447F to the 50 Ohm input of the HP 3585A. The HP 3585A should not be connected to the mixer at this time.

2. Press **[INSTR PRESET]** on the DUT and set up as follows:

Sweep Mode:	CW
Frequency:	2.2 GHz
PEAK	ON
Leveling:	INT
Power Out:	+6 dBm

Set the HP 355D step attenuator to 30 dB.

4-16. FM ACCURACY AND FLATNESS (Cont'd)

3. Press **[INSTR PRESET]** on the HP 3585A and set up as follows:

Start Frequency:	50 kHz
Stop Frequency:	10 MHz
Resolution BW:	10 kHz (default condition)
Video BW:	1 kHz

Turn the HP 3585A's TRACKING GENERATOR knob fully clockwise.

NOTE

Steps 4 and 5 normalize the frequency response variations due to the HP 3585A's tracking generator, HP 355D step attenuator, HP 8447F amplifier, and cables.

4. Set up the HP 3585A as follows:

NOTE

In the following text, the operator is instructed to press the REF LVL key. This key is actually marked **REF LVL**. Do not press the **REFERENCE LEVEL**, **REF LEVEL VOLT**, or **MKR→REF LVL** keys.

Press **[MANUAL] [1] [MHz] [dB/DIV] [2] [dB].**
Press **[REF LVL].** The **[REF LVL]** key is to the left of the rotary knob, in the MARKER/CONTINUOUS ENTRY section of the front panel.
Press **[CLEAR A]** and turn the rotary knob until the marker is 5 divisions up from the bottom horizontal graticule.

Make sure the OVER RANGE message does not come on. **Turn off the Autorange function.** Adjust the **RANGE** if the OVER RANGE message comes on.

5. Press **[CONT]** sweep to take a swept response of the signal path. When a full sweep is completed, press **[STORE A→B]** and **[A-B]**. Turn **VIEW B** OFF.

A strait line should be displayed across the center of the HP 3585A CRT.

Press **[SAVE] [1]** on the HP 3585A.

NOTE

Steps 6 through 9 find the DUT output frequency that places the mixer inputs in quadrature (90° out of phase).

6. Press **[RECALL] [1]** on the HP 3585A. Make sure the DUT is set to the desired CW frequency. Move the output of the HP 8447F to the DUT's AM input. Connect the output of the mixer to the HP 3585A 50 Ohm input.

7. AM is used to find a quadrature frequency that is close to the desired FM flatness test frequency. This is done because at quadrature, AM is rejected and FM response is maximized.

On the DUT, turn **AM** ON. Make sure **FM** is turned OFF.

8. Set up the HP 3585A as follows:

Turn **A-B** OFF. Press **[dB/DIV] [1] [0] [dB] [MANUAL] [1] [0] [0] [kHz]**. Press **[CLEAR A]**.

4-16. FM ACCURACY AND FLATNESS (Cont'd)

9. Press **[SHIFT] [CW]** on the DUT. Note the CW frequency shown in the **ENTRY DISPLAY**. This activates the fine tuning feature on the DUT. The CW frequency will be displayed in the DUT's **ENTRY DISPLAY**. Take note of the flashing cursor in the **ENTRY DISPLAY**. Press the STEP UP or STEP DOWN keys to place the flashing cursor just to the left of the decimal point. Turn the DUT's rotary knob (changing the CW frequency) until the marker on the HP 3585A's CRT dips. (It is normal for a spurious signal to be displayed below the actual marker. Keep turning the DUT's knob until the **marker** dips.)

   Press the STEP UP key twice. Turn the DUT's rotary knob until the marker on the HP 3585A reaches minimum amplitude. This should be possible every 75 MHz or so due to the length of the delay line.

NOTE

Step 15 will instruct the operator to set the DUT's FM sensitivity to 10 MHz/V when performing step 10. If the HP 355D step attenuator has not been set to 50 dB, the DUT's OVERMOD light will come on.

10. Move the output of the HP 8447F to the DUT's FM input. Turn **FM** ON and **AM** OFF. Verify that the DUT's FM sensitivity is set to 1 MHz/V (default condition).

11. Set the HP 3585A to 2 dB/DIV and turn **A-B** back ON. Press **[CLEAR A]**. Press **[REF LVL]** and turn the HP 3585A's rotary knob (usually counter-clockwise) until the marker is on the center horizontal graticule. **If the OVER RANGE beep and message occur, turn the rotary knob in the opposite direction.** Don't be concerned if the marker does not move at first, it may take several complete turns of the rotary knob before any change is noticed on the CRT.

12. Press **[CONT]** sweep on the HP 3585A. **The spectrum analyzer will now display the FM flatness from 50 kHz to 10 MHz.**

    The HP 3585A's marker offset feature can be used to display a digital readout of the signal power level. The readout will be expressed relative to the power level at 100 kHz. To activate this feature, press the following keys on the HP 3585A:

    [MANUAL] [1] [0] [0] [kHz] [OFFSET] [ENTER OFFSET] [MARKER]

    The power level at any chosen frequency between 50 kHz and 10 MHz (relative to the 100 kHz power level) will be displayed in the upper right hand corner of the CRT. Turn the HP 3585A's rotary knob to change the measurement frequency.

13. Determine the maximum and minimum deviation points from the 100 kHz reference. The difference between these points should be $\leq$3 dB. Record the worst case power level on the Test Record Card.

14. Repeat Steps 6 through 13 for frequencies of 2.5, 6.9, 13.4, and 18 GHz. If testing an HP 8341B, proceed to step 15.

    If testing an HP 8340B, also perform the following: Press **[CW] [2] [0] [GHz].** Repeat steps 6 through 13.

15. Repeat Steps 6 through 14 with the HP 355D step attenuator set to 50 dB. When repeating step 10, set the FM sensitivity to 10 MHz/V, not 1 MHz/V.

4-17. HP 8340B/41B HP-IB OPERATION VERIFICATION TEST

NOTE

This HP-IB test is an automated test; a Desktop Computer is required.

Two software listings are supplied. Table 4-32 gives a BASIC program listing for the HP 85F; Table 4-33 gives a BASIC program listing for the HP 9826A (HP 226) or 9836A (HP 236). The test procedure applies to either test program used.

Description

The test program given in Table 4-32 is written to verify the HP 8340B/41B HP-IB interface by writing to and reading from the instrument. The program also displays the DUT's status bytes similar to the format shown in Table 4-31, HP 8340B/41B Status Byte Descriptions. Upon running the program the status bits displayed will change initially as the program outputs an IP (INSTR PRESET), S2 (Single sweep), and two TS (Take Sweep) commands. After about two passes through the output loop (program lines 120 to 300 for the HP 85F, program lines 130 to 350 for the HP 9826A/9836A), the status bits should all be zeros and the DUT should be in LOCAL mode. The procedure instructs the operator to press specific HP 8340B/41B front panel keys and perform certain functions which should set specific bits of the status bytes. This procedure will test most of the bits in the two status bytes. However, if the instrument is working properly, the status bit for the Fault Indicator On, the Oven Cold, and the Self Test Failed will not be tested for the set state. By pressing a controller soft key, the program will test the data bits by outputting a series of binary numbers to the DUT and reading back each number that it outputs. If a bit is held HIGH or LOW, the number read will not agree with the number written and the program will display an error message. This procedure does not test all of the HP-IB control lines.

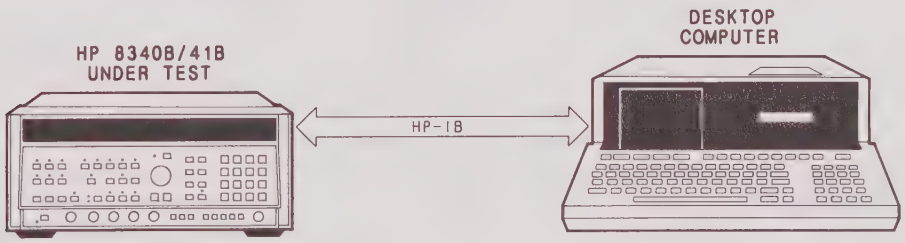

Figure 4-22. HP 8340B/41B HP-IB Operation and Verification Test Setup

Equipment

Desktop Computer ..... HP 85F
(Includes HP 82937A HP-IB Interface and
I/O ROM HP P/N 00085-15002 and
HP 82936 ROM Drawer)
Plotter/Printer ROM ..... HP P/N 00085-15002

or

Desktop Computer ..... HP 9826A(HP 226)/9836A(HP 236)
(With BASIC language and 512K byte memory)

4-17. HP 8340B/41B HP-IB OPERATION VERIFICATION TEST (Cont'd)

Procedure

1. Connect the equipment as shown in Figure 4-22. Enter the program shown in Table 4-32 if the HP 85F is used, or the program in Table 4-33 if the HP 9826A or 9836A is used. Press the RUN key. The program will display the DUT's status bytes similar to Table 4-31. After the program goes through the output loop routine about two times, all status bits should be "0" and the DUT should be in LOCAL mode (front panel REMOTE indicator not ON).

2. Press the DUT's **[INSTR PRESET]** key. After going through the output loop about three times, status byte 1 decimal value should be 24 (bits 4 and 3 set).

NOTE

After pressing an HP 8340B/41B front panel key, watch the displayed decimal value. When the decimal value changes, press the controller PAUSE key. Note the status bits that are set and press CONT.

3. Press the DUT's **[CW]** key. After the program goes through the output loop about three times all status bits should be "0"; however, status byte 1, bit 1, should have been set during one of the output loop passes. Enter **[1] [5] [GHz]** and the byte 1 status bits will change, but after about 2 passes all status bits should be "0".

5. Switch the DUT's rear panel FREQUENCY REFERENCE switch to EXT. Status byte 2 value should be 24 (bits 4 and 3 set). Return the switch to INT.

6. Press the controller softkey K1 (SYNTAX).

NOTE

There will be about a 6 second delay before the status bits change.

The program will output the character string "XYZ" to the DUT. The DUT should not recognize this string and should set status byte 1, bit 5 (SRQ on HP-IB Syntax Error).

7. Press the controller softkey K4 (DATA BIT). The program will test all data bits and display an error message if any bits fail the test, or if all bits pass the test, the program will display "ALL DATA BITS WORKING."

Table 4-31. HP 8340B/41B Status Byte Description

STATUS BYTE (#1)								
BIT #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
DECIMAL VALUE	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
FUNCTION	SRQ on New frequencies or Sweep Time in Effect	REQUEST SERVICE (RQS)	SRQ on HP-IB Syntax Error	SRQ on End of Sweep	SRQ on RF Settled	SRQ on Changed in Extended Status Byte	SRQ on Numeric Entry Completed (HP-IB or Front Panel)	SRQ on Any Front Panel Key Pressed
EXTENDED STATUS BYTE (#2)								
BIT #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
DECIMAL VALUE	**128**	**64** (L)	32 (L)	16 (L)	**8**	**4**	**2**	1 (L)
FUNCTION	Fault Indicator On	RF Unleveled	Power Failure	RF Unlocked	External Freq. Ref. Selected	Oven Cold	Over Mod-ulation	Self Test Failed
(L) See Note 3								

Table 4-32. HP 8340B/41B HP-IB Operation Verification Programming Listing (For Use with HP 85F)

```
10    ! HP 8340B/41B HP-IB OPERATION VERIFICATION
20    !   VERIFICATION TEST
30    !
40    !       15 MARCH 86
50    !
60    I1=719
70    OUTPUT I1 ;"IP S2 TSTS"
80    !
90    ON KEY# 1,"SYNTAX" GOSUB 370
100   ON KEY# 4,DATA BIT GOSUB 400
110   LOCAL 7
120   OUTPUT I1 ;"OS"
130   DISP "HP 8340B/41B STATUS BYTE 1 AND 2"
140   DISP
150   DISP "BYTE_______BIT_____________"
160   DISP "# 7 6 5 4 3 2 1 0 VALUE"
170   DISP "_________________________________"
180   DISP
190   ENTER I1 USING "#,B" ; E,F
200   FOR I=1 TO 2
210   DISP I;
220   IF I=1 THEN N=E
230   IF I=2 THEN N=F
240   FOR J=7 TO 0 STEP -1
250   A=BIT(N,J)
260   DISP A;
270   NEXT J
280   DISP N
290   DISP
300   NEXT I
310   DISP USING "4/,A" ; " "
320   KEY LABEL
330   GOTO 120
340   !
350   !  Syntax Test
360   !
370   OUTPUT I1 ; "XYZ"
380   RETURN
390   !
400   !  Test Data Bits
410   !
420   CLEAR
430   DSP USNG "/,K" ; "TEST DATA BITS"
440   FOR C=0 TO 7
450   B=2^C
460   OUTPUT I1 USING "K,B" , "TI",B
470   WAIT 100
480   ENTER I1 USING "#,B" , D
490   IFB#D THEN DISP "  DATA BIT";C;"NOT WORKING"
500   NEXT C
510   DISP "ALL DATA BITS WORKING"
520   DISP "PRESS CONT"
530   PAUSE
540   RETURN
550   END
```

Table 4-33. HP 8340B/41B HP-IB Operation Verification Programming Listing (For Use with HP 9826A/36A)

```
10      ! HP 8340B/41B HP-IB OPERATION
20      !    VERIFICATION TEST
30      !
40            15 MARCH 86
50      !
60      I1=719
70      OUTPUT I1;"IP S2 TSTS"
80      !
90      OFF KEY
100     ON KEY 1 LABEL "SYNTAX" GOTO Syntax
110     ON KEY 4 LABEL "DATA BIT" GOTO Data__bit
120     LOCAL 7
130     OUTPUT 1; CHR$(12);
140     !
150 Read__status: !
160     OUTPUT I1;"OS"
170     !
180     PRINT TABXY(1,1);"HP 8340B/41B STATUS BYTE 1 AND 2"
190     PRINT
200     PRINT "BYTE_______BIT____________"
210     PRINT "# 7 6 5 4 3 2 1 0 VALUE"
220     PRINT "_________________________________"
230     PRINT
240     ENTER I1 USING "#,B";E,F
250     FOR I=1 TO 2
260       PRINT I;
270       IF I=1 THEN N=E
280       IF I=2 THEN N=F
290       FOR J=7 TO 0 STEP -1
300         A=BIT(N,J)
310         PRINT A;
320       NEXT J
330       PRINT USING "X,5D";N
340       PRINT
350     NEXT I
360     BEEP 200,.01
370     GOTO Read__status
380     !
390 Syntax: !
400     !
410     OUTPUT I1;"XYZ"
420     GOTO Read__status
430     !
440 Data__bit:!
450     !
460     OUTPUT 1;CHR$(12); ! Clear screen
470     DISP USING "/,K";    TEST DATA BITS"
480     FOR C=0 TO 7
490       B=2^C
500       OUTPUT I1 USING "K,B";"TI",B
510       WAIT .1
520     ENTER I1 USING "#,B";D
530       IFB-D<1 THEN GOTO 550
540     IF B<>D THEN DISP "  DATA BIT  ";C;;NOT WORKING"
550     NEXT C
560     !
570     PRINT "ALL DATA BITS WORKING"
580     DISP "PRESS CONTINUE"
590     PAUSE
600     DISP
610     GOTO Read__status
620     END
```

Hewlett-Packard Model 8340B/41B
Synthesized Sweepers

Date: _____

Model Number: _____

Serial Number: _____

Tested By: _____

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-1. Internal Time Base Aging Rate					
T_1 = Time for 360 degree phase change	3			____ seconds	
T_2 = Time between T_1 and T_3	4			_____ hours	
T_3 = Time for 360 degree phase change				____ seconds	
Calculated Aging Rate	5			____ per day	

HP 8340B/41B Test Record Card (2 of 30)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-2. Frequency Range and CW Mode Accuracy					
Frequency Range Check					
10 MHz	2	Freq. ±1 Hz ± Counter Resolution		_____ MHz	
20.0 GHz (HP 8341B)	3	Freq. ±3 Hz ± Counter Resolution		_____ GHz	
26.5 GHz (HP 8340B)	3	Freq. ±4 Hz ± Counter Resolution		_____ GHz	
M/N Divider Check	4b				
(M Divider)		Freq. ±1 Hz ± Counter Resolution			
M = 8 N = 13		2490 MHz		_____ MHz	
9		2480 MHz		_____ MHz	
10		2470 MHz		_____ MHz	
11		2460 MHz		_____ MHz	
12		2450 MHz		_____ MHz	
13		2440 MHz		_____ MHz	
14		2430 MHz		_____ MHz	
15		2420 MHz		_____ MHz	
16		2410 MHz		_____ MHz	
17		2400 MHz		_____ MHz	
18		2390 MHz		_____ MHz	
19		2380 MHz		_____ MHz	
20		2370 MHz		_____ MHz	
21		2360 MHz		_____ MHz	
22		2350 MHz		_____ MHz	
23		2340 MHz		_____ MHz	
24		2330 MHz		_____ MHz	
25		2320 MHz		_____ MHz	
26		2310 MHz		_____ MHz	
27		2300 MHz		_____ MHz	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-2. Frequency Range and CW Mode Accuracy (Cont'd)					
M/N Divider Check	5b				
(N Divider)		Freq. ±1 Hz ± Counter Resolution			
M = 27 N = 13		2300 MHz		_____ MHz	
14		2500 MHz		_____ MHz	
15		2700 MHz		_____ MHz	
16		2900 MHz		_____ MHz	
17		3100 MHz		_____ MHz	
18		3300 MHz		_____ MHz	
19		3500 MHz		_____ MHz	
20		3700 MHz		_____ MHz	
21		3900 MHz		_____ MHz	
22		4100 MHz		_____ MHz	
23		4300 MHz		_____ MHz	
24		4500 MHz		_____ MHz	
25		4700 MHz		_____ MHz	
26		4900 MHz		_____ MHz	
27		5100 MHz		_____ MHz	
28		5300 MHz		_____ MHz	
29		5500 MHz		_____ MHz	
30		5700 MHz		_____ MHz	
31		5900 MHz		_____ MHz	
32		6100 MHz		_____ MHz	
33		6300 MHz		_____ MHz	
34		6500 MHz		_____ MHz	
35		6700 MHz		_____ MHz	
36		6900 MHz		_____ MHz	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-2. Frequency Range and CW Mode Accuracy (Cont'd)					
20-30 Loop Check (N2 Divider)					
DUT ENTRY DISPLAY		DUT START Frequency			
CF Frequency:		Freq. ±1 Hz ± Counter Resolution			
2.310500 GHz	6b	2.310000 GHz		_____ GHz	
2.310501	6c	2.310001		_____ GHz	
2.310502		2.310002		_____ GHz	
2.310503		2.310003		_____ GHz	
2.310504		2.310004		_____ GHz	
2.310505		2.310005		_____ GHz	
2.310506		2.310006		_____ GHz	
2.310507		2.310007		_____ GHz	
2.310508		2.310008		_____ GHz	
2.310509		2.310009		_____ GHz	
2.310510		2.310010		_____ GHz	
2.310510	6d	2.310010		_____ GHz	
2.310520	6e	2.310020		_____ GHz	
2.310530		2.310030		_____ GHz	
2.310540		2.310040		_____ GHz	
2.310550		2.310050		_____ GHz	
2.310560		2.310060		_____ GHz	
2.310570		2.310070		_____ GHz	
2.310580		2.310080		_____ GHz	
2.310590		2.310090		_____ GHz	
2.310600		2.310100		_____ GHz	
2.310600	6f	2.310100		_____ GHz	
2.310700	6g	2.310200		_____ GHz	
2.310800		2.310300		_____ GHz	
2.310900		2.310400		_____ GHz	
2.311000		2.310500		_____ GHz	
2.311100		2.310600		_____ GHz	
2.311200		2.310700		_____ GHz	
2.311300		2.310800		_____ GHz	
2.311400		2.310900		_____ GHz	
2.311500		2.311000		_____ GHz	
2.311500	6h	2.311000		_____ GHz	
2.312500	6i	2.312000		_____ GHz	
2.313500		2.313000		_____ GHz	
2.314500		2.314000		_____ GHz	
2.315500		2.315000		_____ GHz	
2.316500		2.316000		_____ GHz	
2.317500		2.317000		_____ GHz	
2.318500		2.318000		_____ GHz	
2.319500		2.319000		_____ GHz	
2.320500		2.32000		_____ GHz	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-2. Frequency Range and CW Mode Accuracy (Cont'd)					
20-30 Loop Check (N1 Divider)					
DUT ENTRY DISPLAY		Frequency Counter Indicator Freq. ±1 Hz ± Counter Resolution			
CW Frequency:					
2319.97 MHz	7a			_____ MHz	
2319.96	7c			_____ MHz	
2319.95				_____ MHz	
2319.94				_____ MHz	
2319.93				_____ MHz	
2319.92				_____ MHz	
2319.91				_____ MHz	
2319.90				_____ GHz	
2319.89				_____ MHz	
2319.88				_____ MHz	
2319.87				_____ MHz	
2319.87	7d			_____ MHz	
2319.77	7e			_____ MHz	
2319.67				_____ MHz	
2319.57				_____ MHz	
2319.47				_____ MHz	
2319.37				_____ MHz	
2319.27				_____ MHz	
2319.17				_____ MHz	
2319.07				_____ MHz	
2318.97				_____ MHz	
2318.97	7f			_____ MHz	
2317.97	7g			_____ MHz	
2316.97				_____ MHz	
2315.97				_____ MHz	
2314.97				_____ MHz	
2313.97				_____ MHz	
2312.97				_____ MHz	
2311.97				_____ MHz	
2310.97				_____ MHz	

HP 8340B/41B Test Record Card (6 of 30)

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-3. Sweep Time Accuracy					
10 milliseconds	4		9.5 ms	_____ ms	10.5 ms
100 milliseconds			95 ms	_____ ms	105 ms
1 second			0.95 s	_____ s	1.05 s
10 seconds			9.5 s	_____ s	10.5 s
50 seconds			47.5 s	_____ s	52.5 s

SPECIFICATIONS TESTED Limits		Step	TEST Conditions		Lower Limit	Measured Value	Upper Limit
4-4. Swept Frequency Accuracy 20% of Band Accuracy		8					
DUT Start Freq. (GHz)	**DUT Stop Freq. (GHz)**		**20% of Band**	**Test Limit (kHz)**	**Spectrum Analyzer Center Freq. (GHz)**	**Spectrum Analyzer Center Freq. GHz**	**Spectrum Analyzer Center Freq. (GHz)**
2.3	2.300099		2.3000198	±0.99	2.30001881	_____	2.30002079
2.3	2.300101		2.3000202	±1.01	2.30001919	_____	2.30002121
2.3	2.300499		2.3000998	±4.99	2.30009481	_____	2.30010479
2.3	2.300501		2.3001002	±5.01	2.30009519	_____	2.30010521
2.3	2.30499		2.300998	±49.9	2.3009481	_____	2.3010479
2.3	2.30501		2.301002	±100.02	2.30090198	_____	2.30110202
2.3	2.31		2.302	±200	2.3018	_____	2.3022
2.3	2.32		2.304	±400	2.3036	_____	2.3044
2.3	2.33		2.306	±600	2.3054	_____	2.3066
2.3	2.34		2.308	±800	2.3072	_____	2.3088
2.3	2.349		2.3098	±998	2.308802	_____	2.310798
2.3	2.3501		2.31002	±1020	2.309	_____	2.31104
2.3	2.36		2.312	±1200	2.3108	_____	2.3132
2.3	2.37		2.314	±1400	2.3126	_____	2.3154
2.3	2.38		2.316	±1600	2.3144	_____	2.3176
2.3	2.39		2.318	±1800	2.3162	_____	2.3198
2.3	2.3999		2.31998	±1980	2.318	_____	2.32196
2.3	2.4001		2.32002	±2002	2.318018	_____	2.322022
2.3	2.799		2.3998	±4990	2.39481	_____	2.40479
2.3	2.801		2.4002	±5010	2.39519	_____	2.40521
2.3	7.29		3.298	±49900	3.2481	_____	3.3479
2.3	7.31		3.302	±50000	3.352	_____	3.352
2.3	8.3		3.500	±50000	3.45	_____	3.55
2.3	16.452		5.1304	±50000	5.0804	_____	5.1804
2.3	20.0		5.84	±50000	5.79	_____	5.89
2.3	24.55[1]		6.75	±50000	6.70	_____	6.80
2.3	26.5[1]		7.14	±50000	7.09	_____	7.19

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits		Step	TEST Conditions		Lower Limit	Measured Value	Upper Limit
4-4. Swept Frequency Accuracy (Cont'd) 50% of Band Accuracy		8					
DUT Start Freq. (GHz)	**DUT Stop Freq. (GHz)**		**50% of Band**	**Test Limit (kHz)**	**Spectrum Analyzer Center Freq. (GHz)**	**Spectrum Analyzer Center Freq. GHz**	**Spectrum Analyzer Center Freq. (GHz)**
2.3	2.300099		2.3000495	±0.99	2.30004851	_____	2.30005049
2.3	2.300101		2.3000505	±1.01	2.30004949	_____	2.30005151
2.3	2.300499		2.3002495	±4.99	2.30024451	_____	2.30025449
2.3	2.300501		2.3002505	±5.01	2.30024549	_____	2.30025551
2.3	2.30499		2.302495	±49.9	2.3024451	_____	2.3025449
2.3	2.30501		2.302505	±100.02	2.30240498	_____	2.30260502
2.3	2.31		2.305	±200	2.3048	_____	2.3052
2.3	2.32		2.310	±400	2.3096	_____	2.3104
2.3	2.33		2.315	±600	2.3144	_____	2.3156
2.3	2.34		2.320	±800	2.3192	_____	2.3208
2.3	2.349		2.3245	±998	2.323502	_____	2.325498
2.3	2.3501		2.32505	±1020	2.32403	_____	2.32607
2.3	2.36		2.33	±1200	2.3288	_____	2.3312
2.3	2.37		2.335	±1400	2.3336	_____	2.3364
2.3	2.38		2.34	±1600	2.3384	_____	2.3416
2.3	2.39		2.345	±1800	2.3432	_____	2.3468
2.3	2.3999		2.34995	±1980	2.34797	_____	2.35193
2.3	2.4001		2.35005	±2002	2.348048	_____	2.352052
2.3	2.799		2.5495	±4990	2.54451	_____	2.55449
2.3	2.801		2.5505	±5010	2.54549	_____	2.55551
2.3	7.29		4.795	±49900	4.7451	_____	4.8449
2.3	7.31		4.805	±50000	4.755	_____	4.855
2.3	8.3		5.300	±50000	5.250	_____	5.350
2.3	16.452		9.376	±50000	9.326	_____	9.426
2.3	20.0		11.15	±50000	11.1	_____	11.2
2.3	24.55[1]		13.425	±50000	13.375	_____	13.475
2.3	26.5[1]		14.4	±50000	14.35	_____	14.45

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits		Step	TEST Conditions		Lower Limit	Measured Value	Upper Limit
4-4. Swept Frequency Accuracy (Cont'd) 80% of Band Accuracy		8					
DUT Start Freq. (GHz)	**DUT Stop Freq. (GHz)**		**80% of Band**	**Test Limit (kHz)**	**Spectrum Analyzer Center Freq. (GHz)**	**Spectrum Analyzer Center Freq. GHz**	**Spectrum Analyzer Center Freq. (GHz)**
2.3	2.300099		2.3000792	±0.99	2.30007821	_____	2.30008019
2.3	2.300101		2.300808	±1.01	2.30007979	_____	2.30008181
2.3	2.300499		2.3003992	±4.99	2.30039421	_____	2.30040419
2.3	2.300501		2.3004008	±5.01	2.30039579	_____	2.30040581
2.3	2.30499		2.303992	±49.9	2.3039421	_____	2.3040419
2.3	2.30501		2.304008	±100.02	2.30390798	_____	2.3041802
2.3	2.31		2.308	±200	2.3078	_____	2.3082
2.3	2.32		2.316	±400	2.3156	_____	2.3164
2.3	2.33		2.324	±600	2.3234	_____	2.3246
2.3	2.34		2.332	±800	2.3312	_____	2.3328
2.3	2.349		2.3392	±998	2.338202	_____	2.340198
2.3	2.3501		2.34008	±1020	2.33906	_____	2.3411
2.3	2.36		2.348	±1200	2.3468	_____	2.3492
2.3	2.37		2.356	±1400	2.3546	_____	2.3574
2.3	2.38		2.364	±1600	2.3624	_____	2.3656
2.3	2.39		2.372	±1800	2.3702	_____	2.3738
2.3	2.3999		2.37992	±1980	2.37794	_____	2.3819
2.3	2.4001		2.38008	±2002	2.378078	_____	2.382082
2.3	2.799		2.6992	±4990	2.69421	_____	2.70419
2.3	2.801		2.7008	±5010	2.69579	_____	2.70581
2.3	7.29		6.292	±49900	6.2421	_____	6.3419
2.3	7.31		6.308	±50000	6.258	_____	6.358
2.3	8.3		7.1	±50000	7.05	_____	7.15
2.3	16.452		13.6216	±50000	13.5716	_____	13.6716
2.3	20.0		14.16	±50000	14.11	_____	14.21
2.3	24.55[1]		20.1	±50000	20.05	_____	20.15
2.3	26.5[1]		21.66	±50000	21.61	_____	21.71

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-5. Maximum Leveled Output Power and Power Accuracy					
Maximum Leveled Power Band 0					
ENTRY DISPLAY Power Indication	3	Continuous Sweep, Auto Sweep Time		_____ dBm	
	4	Single Sweep, Auto Sweep Time		_____ dBm	
	5	Single Sweep, 2 Second Sweep Time		_____ dBm	
Lowest power level recorded in step 3, 4, or 5	6			_____ dBm	
Minimum Power Frequency		M2 Frequency		_____ GHz	
Power Meter Indication	7	Standard Instrument (F.P. Out with Atten.)	+10 dBm	_____ dBm	
		Option 001 (F.P. Out No. Atten.)	+10 dBm	_____ dBm	
		Option 004 (R.P. Out with Atten.)	+10 dBm	_____ dBm	
		Option 005 (R.P. Out No Atten.)	+10 dBm	_____ dBm	
Maximum Leveled Power Band 1					
ENTRY DISLAY Power Indication	3	Continuous Sweep, Auto Sweep Time		_____ dBm	
	4	Single Sweep, Auto Sweep Time		_____ dBm	
	5	Single Sweep, 2 Second Sweep Time		_____ dBm	
Lowest power level recorded in step 3, 4, or 5	6			_____ dBm	
Minimum Power Frequency		M2 Frequency		_____ GHz	
Power Meter Indication	7	Standard Instrument (F.P. Out with Atten.)	+12 dBm	_____ dBm	
		Option 001 (F.P. Out No Atten.)	+13 dBm	_____ dBm	
		Option 004 (R.P. Out with Atten.)	+11 dBm	_____ dBm	
		Option 005 (R.P. Out No Atten.)	+12 dBm	_____ dBm	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-5. Maximum Leveled Output Power and Power Accuracy (Cont'd)					
Maximum Leveled Power Band 2					
ENTRY DISPLAY Power					
Indication	3	Continuous Sweep, Auto Sweep Time		_____ dBm	
	4	Single Sweep, Auto Sweep Time		_____ dBm	
	5	Single Sweep, 2 Second Sweep Time		_____ dBm	
Lowest power level recorded in step 3, 4, or 5	6			_____ dBm	
Minimum Power Frequency		M2 Frequency		_____ GHz	
Power Meter Indication	7	Standard Instrument (F.P. Out with Atten.)	+10 dBm	_____ dBm	
		Option 001 (F.P. Out No Atten.)	+12 dBm	_____ dBm	
		Option 004 (R.P. Out with Atten.)	+9 dBm	_____ dBm	
		Option 005 (R.P. Out No Atten.)	+11 dBm	_____ dBm	
Maximum Leveled Power Band 3					
ENTRY DISPLAY Power Indication	3	Continuous Sweep, Auto Sweep time		_____ dBm	
	4	Single Sweep, Auto Sweep Time		_____ dBm	
	5	Single Sweep, 2 Second Sweep Time		_____ dBm	
Lowest power level recorded in step 3, 4, or 5	6			_____ dBm	
Minimum Power Frequency		M2 Frequency		_____ GHz	
Power Meter Indication	7	Standard Instrument (F.P. Out with Atten.)	+9 dBm	_____ dBm	
		Option 001 (F.P. Out No Atten.)	+11 dBm	_____ dBm	
		Option 004 (R.P. Out with Atten.)	+7 dBm	_____ dBm	
		Option 005 (R.P. Out No Atten.)	+9 dBm	_____ dBm	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-5. Maximum Leveled Output Power and Power Accuracy (Cont'd)					
Maximum Leveled Power Band 4 (20-23 GHz)[1] ENTRY DISPLAY Power					
Indication	3	Continuous Sweep, Auto Sweep Time		_____ dBm	
	4	Single Sweep, Auto Sweep Time		_____ dBm	
	5	Single Sweep, 2 Second Sweep Time		_____ dBm	
Lower power level recorded in step 3, 4, or 5	6			_____ dBm	
Minimum Power Frequency		M2 Frequency		_____ GHz	
Power Meter Indication	7	Standard Instrument (F.P. out with Atten.)	+3 dBm	_____ dBm	
		Option 001 (F.P. Out No Atten.)	+6 dBm	_____ dBm	
		Option 004 (R.P. Out with Atten.)	+1 dBm	_____ dBm	
		Option 005 (R.P. Out No Atten.)	+4 dBm	_____ dBm	
Maximum Leveled Power Band 4 (23-26.5 GHz)[1] ENTRY DISPLAY Power					
Indication	3	Continuous Sweep, Auto Sweep Time		_____ dBm	
	4	Single Sweep, Auto Sweep Time		_____ dBm	
	5	Single Sweep, 2 Second Sweep Time		_____ dBm	
Lowest power level recorded in step 3, 4, or 5	6			_____ dBm	
Minimum Power Frequency		M2 Frequency		_____ GHz	
Power Meter Indication	7	Standard Instrument (F.P. Out with Atten.)	+1 dBm	_____ dBm	
		Option 001 (F.P. Out No Atten.)	+4 dBm	_____ dBm	
		Option 004 (R.P. Out with Atten.)	−1 dBm	_____ dBm	
		Option 005 (R.P. Out No Atten.)	+2 dBm	_____ dBm	

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-5. Maximum Leveled Output Power and Power Accuracy (Cont'd)					
Flatness	9				
Band 0 Measurement					
Minimum Power Frequency	13	M2 Frequency		_____ GHz	
Minimum Power Level	14	M2 Power Level		_____ dBm	
Maximum Power Frequency	15	M1 Frequency		_____ GHz	
Maximum Power Level		M1 Power Level		_____ dBm	
Band 1 Measurement					
Minimum Power Frequency	13	M2 Frequency		_____ GHz	
Minimum Power Level	14	M2 Power Level		_____ dBm	
Maximum Power Frequency	15	M1 Frequency		_____ GHz	
Maximum Power Level		M1 Power Level		_____ dBm	
Band 2 Measurement					
Minimum Power Frequency	13	M2 Frequency		_____ GHz	
Minimum Power Level	14	M2 Power Level		_____ dBm	
Maximum Power Frequency	15	M1 Frequency		_____ GHz	
Maximum Power Level		M1 Power Level		_____ dBm	
Band 3 Measurement					
Minimum Power Frequency	13	M2 Frequency		_____ GHz	
Minimum Power Level	14	M2 Power Level		_____ dBm	
Maximum Power Frequency	15	M1 Frequency		_____ GHz	
Maximum Power Level		M1 Power Level		_____ dBm	
Band 4 Measurement[1]					
Minimum Power Frequency	13	M2 Frequency		_____ GHz	
Minimum Power Level	14	M2 Power Level		_____ dBm	
Maximum Power Frequency	15	M1 Frequency		_____ GHz	
Maximum Power Level		M1 Power Level		_____ dBm	

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-5. Maximum Leveled Output Power and Power Accuracy (Cont'd)					
Flatness (Maximum minus Minimum Calculations)	18				
Band 0 Calculation		≤1.2 dB (Standard) ≤1.4 dB (Option 004) ≤1.2 dB (Option 001) ≤1.4 dB (Option 005)		_____ dB	
Band 1 Calculation		≤2.2 dB (Standard) ≤2.6 dB (Option 004) ≤1.8 dB (Option 001) ≤2.2 dB (Option 005)		_____ dB	
Band 2 Calculation		≤2.2 dB (Standard) ≤2.6 dB (Option 004) ≤1.8 dB (Option 001) ≤2.2 dB (Option 005)		_____ dB	
Band 3 Calculation		≤2.2 dB (Standard) ≤2.6 dB (Option 004) ≤1.8 dB (Option 001) ≤2.2 dB (Option 005)		_____ dB	
Band 4 Calculation[1]		≤3.2 dB (Standard) ≤3.6 dB (Option 004) ≤2.6 dB (Option 001) ≤3.0 dB (Option 005)		_____ dB	

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-6. External Leveling		(Using Negative Crystal Detector)			
Leveling Voltage (dBv)					
+6	3		−1.883 V	_____ V	−2.114 V
0			−0.944 V	_____ V	−1.059 V
−10			−0.2983 V	_____ V	−0.3352 V
−20			−0.0942 V	_____ V	−0.1061 V
−30			−29.65 mV	_____ mV	−33.70 mV
−40			−9.24 mV	_____ mV	−10.79 mV
−50			−2.785 mV	_____ mV	−3.550 mV
−60			−0.744 mV	_____ mV	−1.259 mV
−66			−0.273 mV	_____ mV	−0.731 mV

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SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-7. Spurious Signals (10 MHz to 22 GHz - HP 8340B) (10 MHz to 20 GHz - HP 8341B)					
Frequency of Interest Selected	4				
	6	Refer to Table 4-16 for Specifications			
4-8. Spurious Signals (22 to 26.5 GHz HP 8340B only)					
Frequency of Interest Selected	2				
	6	Refer to Table 4-17 for Specifications			

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-9. Single Sideband Phase Noise from Steps 11 through 38 (Using Tables 4-19, 4-20, and 4-22)	38				
Instruments w/o Opt. 007					
2.202 GHz					
Offset = 30 Hz				_____ dBc	<−64dBc
100 Hz				_____ dBc	<−70 dBc
1 kHz				_____ dBc	<−78 dBc
10 kHz				_____ dBc	<−86 dBc
100 kHz				_____ dBc	<−107 dBc
6.902 GHz					
Offset = 30 Hz				_____ dBc	<−64 dBc
100 Hz				_____ dBc	<−70 dBc
1 kHz				_____ dBc	<−78 dBc
10 kHz				_____ dBc	<−86 dBc
100 kHz				_____ dBc	<−107 dBc
13.402 GHz					
Offset = 30 Hz				_____ dBc	<−58 dBc
100 Hz				_____ dBc	<−64 dBc
1 kHz				_____ dBc	<−72 dBc
10 kHz				_____ dBc	<−80 dBc
100 kHz				_____ dBc	<−101 dBc
19.502 GHz					
Offset = 30 Hz				_____ dBc	<−54 dBc
100 Hz				_____ dBc	<−60 dBc
1 kHz				_____ dBc	<−68 dBc
10 kHz				_____ dBc	<−76 dBc
100 kHz				_____ dBc	<−97 dBc
26.032 GHz[1]					
Offset = 30 Hz				_____ dBc	<−52 dBc
100 Hz				_____ dBc	<−58 dBc
1 kHz				_____ dBc	<−66 dBc
10 kHz				_____ dBc	<−74 dBc
100 kHz				_____ dBc	<−95 dBc

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-9. Single Sideband Phase Noise from Steps 11 through 38 (Using Tables 4-19, 4-20, and 4-22) (Cont'd)	38				
Option 007 – Relaxed Phase Noise Specifications					
2.202 GHz					
Offset = 100 Hz				_____ dBc	<−67 dBc
1 kHz				_____ dBc	<−75 dBc
10 kHz				_____ dBc	<−83 dBc
100 kHz				_____ dBc	<−107 dBc
6.902 GHz					
Offset = 100 Hz				_____ dBc	<−67 dBc
1 kHz				_____ dBc	<−75 dBc
10 kHz				_____ dBc	<−83 dBc
100 kHz				_____ dBc	<−107 dBc
13.402 GHz					
Offset = 100 Hz				_____ dBc	<−61 dBc
1 kHz				_____ dBc	<−69 dBc
10 kHz				_____ dBc	<−77 dBc
100 kHz				_____ dBc	<−101 dBc
19.502 GHz					
Offset = 100 Hz				_____ dBc	<−57 dBc
1 kHz				_____ dBc	<−65 dBc
10 kHz				_____ dBc	<−73 dBc
100 kHz				_____ dBc	<−97 dBc
26.032 GHz[1]					
Offset = 100 Hz				_____ dBc	<−55 dBc
1 kHz				_____ dBc	<−63 dBc
10 kHz				_____ dBc	<−71 dBc
100 kHz				_____ dBc	<−95 dBc

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-10. Power Sweep					
1 GHz					
Start Level	5			_____ dBm	
End Level	6			_____ dBm	
Power Sweep Range	7	Must be ≥20 dB difference	20 dB	_____ dB	
5 GHz					
Start Level	5			_____ dBm	
End Level	6			_____ dBm	
Power Sweep Range	7	Must be ≥20 dB difference	20 dB	_____ dB	
10 GHz					
Start Level	5			_____ dBm	
End Level	6			_____ dBm	
Power Sweep Range	7	Must be ≥20 dB difference	20 dB	_____ dB	
15 GHz					
Start Level	5			_____ dBm	
End Level	6			_____ dBm	
Power Sweep Range	7	Must be ≥20 dB difference	20 dB	_____ dB	
26 GHz[1]					
Start Level	5			_____ dBm	
End Level	6			_____ dBm	
Power Sweep Range	7	Must be ≥20 dB difference	20 dB	_____ dB	

1. Perform this step only when testing an HP 8340B.

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-11. Pulse Modulation ON/ OFF Ratio					
1 GHz	4	ΔAmplitude must be > 80 dB	80 dB	_____ dB	
3 GHz			80 dB	_____ dB	
9 GHz			80 dB	_____ dB	
15 GHz			80 dB	_____ dB	
22 GHz*			80 dB	_____ dB	
4-12. Pulse Modulation Rise and Fall Time					
1 GHz					
Rise Time	6	Rise Times: 90% point should		_____ nsec	25 nsec
Fall Time	8	be <25 nanoseconds from 10% point		_____ nsec	25 nsec
3 GHz					
Rise Time	6	Fall Times: 10% point should be		_____ nsec	25 nsec
Fall Time	8	<25 nanoseconds from 90% point		_____ nsec	25 nsec
9 GHz					
Rise Time	6			_____ nsec	25 nsec
Fall Time	8			_____ nsec	25nsec
15 GHz					
Rise Time	6			_____ nsec	25 nsec
Fall Time	8			_____ nsec	25 nsec
22 GHz[1]					
Rise Time	6			_____ nsec	25 nsec
Fall Time	8			_____ nsec	25 nsec

1. Perform this step only when testing an HP 8340B.

NOTE

Tests 4-11, 4-12, 4-13, and 4-14 do not apply to instruments equipped with Option 006, Delete Pulse Modulation.

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-13. Pulse Modulation Accuracy					
DUT CW Freq. = 1 GHz PRF = 100 kHz					
Pulse Width = 100 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+3 dB
Pulse Width = 200 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB
Pulse Width = 500 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 1000 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Repetition Freq. Range DUT CW Freq. = 1 GHz	10				
Minimum PRF PRF = 100 Hz PW = 1 microsecond	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Maximum PRF PRF = 5 MHz PW = 100 nanoseconds	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+3 dB
DUT CW Freq. = 3 GHz PRF = 100 kHz					
Pulse Width = 100 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB
Pulse Width = 200 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 500 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 1000 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+3 dB

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-13. Pulse Modulation Accuracy (Cont'd)					
Pulse Repetition Freq. Range DUT CW Freq. = 3 GHz	10				
Minimum PRF PRF = 100 Hz PW = 1 microsecond	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Maximum PRF PRF = 5 MHz PW = 100 nanoseconds	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB
DUT CW Freq. = 9 GHz PRF = 100 kHz					
Pulse Width = 100 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB
Pulse Width = 200 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 500 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 1000 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Repetition Freq. Range DUT CW Freq. = 9 GHz	10				
Minimum PRF PRF = 100 Hz PW = 1 microsecond	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Maximum PRF PRF = 5 MHz PW = 100 nanoseconds	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-13. Pulse Modulation Accuracy (Cont'd)					
DUT CW Freq. = 15 GHz PRF = 100 kHz					
Pulse Width = 100 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB
Pulse Width = 200 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 500 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 1000 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Repetition Freq. Range DUT CW Freq. = 15 GHz	10				
Minimum PRF PRF = 100 Hz PW = 1 microsecond	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Maximum PRF PRF = 5 MHz PW = 100 nanoseconds	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB
		NOTE **Perform the following steps only when testing an HP 8340B.**			
HP 8340B CW Freq. = 22 GHz PRF = 100 kHz					
Pulse Width = 100 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB
Pulse Width = 200 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 500 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Pulse Width = 1000 ns	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-13. Pulse Modulation Accuracy (Cont'd)					
		NOTE **Perform the following steps only when testing an HP 8340B.**			
Pulse Repetition Freq. Range 8340B CW Freq. = 22 GHz	10				
Minimum PRF PRF = 100 Hz PW = 1 microsecond	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+0.3 dB
Maximum PRF PRF = 5 MHz PW = 100 nanoseconds	6	ENTRY DISPLAY Power Level		_____ dBm	
	7	ENTRY DISPLAY Power Level		_____ dBm	
	8	Δ Power between steps 6 and 7	>−0.3 dB	_____ dB	<+1.5 dB

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-14. Pulse Modulation Video Feedthrough					
DUT CW Freq. = 0.4 GHz					
Power Level = +8 dBm	7	Oscilloscope peak voltage		_____ mV	< 12 mV
0 dBm				_____ mV	<5 mV
−10 dBm				_____ mV	<1.6 mV
DUT CW Freq. = 1 GHz	7				
Power Level = +8 dBm				_____ mV	<12 mV
0 dBm				_____ mV	<5 mV
−10 dBm				_____ mV	<1.6 mV
DUT CW Freq. = 1.5 GHz	7				
Power Level = +8 dBm				_____ mV	<12 mV
0 dBm				_____ mV	<5 mV
−10 dBm				_____ mV	<1.6 mV
DUT CW Freq. = 2 GHz	7				
Power Level = +8 dBm				_____ mV	<12 mV
0 dBm				_____ mV	<5 mV
−10 dBm				_____ mV	<1.6 mV
DUT CW Freq. = >2.3 GHz	10				
Power Level = −10 dBm				_____ mV	<0.2 mV
(Any Frequency Selected)					

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-15. Amplitude Modulation					
AM Sensitivity					
DUT Freq. = 1.5 GHz Power = −5 dBm	2				
	4	Power Meter Indication		_____ dB	
+30% Modulation	5	Power Meter Change	>2.18 dB	_____ dB	<2.38 dB
−30% Modulation	6	Power Meter Change	>2.91 dB	_____ dB	<3.29 dB
DUT Freq. = 1.5 GHz Power = +5 dBm	7				
	4	Power Meter Indication		_____ dB	
+30% Modulation	5	Power Meter Change	>2.18 dB	_____ dB	<2.38 dB
−30% Modulation	6	Power Meter Change	>2.91 dB	_____ dB	<3.29 dB
DUT Freq. = 4.5 GHz Power = −5 dBm	8				
	4	Power Meter Indication		_____ dB	
+30% Modulation	5	Power Meter Change	>2.18 dB	_____ dB	<2.38 dB
−30% Modulation	6	Power Meter Change	>2.91 dB	_____ dB	<3.29 dB
DUT Freq. = 4.5 GHz Power = +5 dBm	8				
	4	Power Meter Indication		_____ dB	
+30% Modulation	5	Power Meter Change	>2.18 dB	_____ dB	<2.38 dB
−30% Modulation	6	Power Meter Change	>2.91 dB	_____ dB	<3.29 dB
DUT Freq. = 1.5 GHz					
AM Frequency Response	11	Note DVM Indication		_____ Vrms	
Funct. Gen. = 1 kHz	12	Flatness (read on Modulation		_____ dB	≤ ±0.2 dB
100 Hz	13	Analyzer)		_____ dB	≤ ±0.2 dB
200 Hz				_____ dB	≤ ±0.2 dB
500 Hz				_____ dB	≤ ±0.2 dB
1 kHz				_____ dB	≤ ±0.2 dB
2 kHz				_____ dB	≤ ± 0.2 dB
5 kHz				_____ dB	≤ ± 0.2 dB
10 kHz				_____ dB	≤ ± 0.2 dB
AM Bandwidth Funct. Gen. = 100 kHz Adjust output level to that noted in Step 11	14	Modulation Analyzer Indication	≥−3 dB	_____ dB	
AM Depth Funct. Gen. = 1 kHz	15	Maximum Modulation Depth	>90%	_____ %	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-15. Amplitude Modulation (Cont'd)					
DUT Freq. = 3 GHz					
AM Frequency Response	11	Note DVM Indication		_____ Vrms	
Funct. Gen. = 1 kHz	12	Flatness (read on Modulation		_____ dB	≤ ±0.2 dB
100 Hz	13	Analyzer)		_____ dB	≤ ±0.2 dB
200 Hz				_____ dB	≤ ±0.2 dB
500 Hz				_____ dB	≤ ±0.2 dB
1 kHz				_____ dB	≤ ±0.2 dB
2 kHz				_____ dB	≤ ±0.2 dB
5 kHz				_____ dB	≤ ±0.2 dB
10 kHz				_____ dB	≤ ±0.2 dB
AM Bandwidth Funct. Gen. = 100 kHz Adjust output level to that noted in Step 11	14	Modulation Analyzer Indication	≥ −3 dB	_____ dB	
AM Depth Funct. Gen. = 1 kHz	15	Maximum Modulation Depth	>90%	_____ %	
DUT Freq. = 9 GHz					
AM Frequency Response	11	Note DVM Indication		_____ Vrms	
Funct. Gen. = 1 kHz	12	Flatness (read on Modulation		_____ dB	≤ ±0.2 dB
100 Hz	13	Analyzer)		_____ dB	≤ ±0.2 dB
200 Hz				_____ dB	≤ ±0.2 dB
500 Hz				_____ dB	≤ ±0.2 dB
1 kHz				_____ dB	≤ ±0.2 dB
2 kHz				_____ dB	≤ ±0.2 dB
5 kHz				_____ dB	≤ ±0.2 dB
10 kHz				_____ dB	≤ ±0.2 dB
AM Bandwidth Funct. Gen. = 100 kHz Adjust output level to that noted in Step 11	14	Modulation Analyzer Indication	≥ −3 dB	_____ dB	
AM Depth Funct. Gen. = 1 kHz	15	Maximum Modulation Depth	>90%	_____ %	
DUT Freq. = 15 GHz					
AM Frequency Response	11	Note DVM Indication		_____ Vrms	
Funct. Gen. = 1 kHz	12	Flatness (read on Modulation		_____ dB	≤ ±0.2 dB
100 Hz	13	Analyzer)		_____ dB	≤ ±0.2 dB
200 Hz				_____ dB	≤ ±0.2 dB
500 Hz				_____ dB	≤ ±0.2 dB
1 kHz				_____ dB	≤ ±0.2 dB
2 kHz				_____ dB	≤ ±0.2 dB
5 kHz				_____ dB	≤ ±0.2 dB
10 kHz				_____ dB	≤ ±0.2 dB
AM Bandwidth Funct. Gen. = 100 kHz Adjust output level to that noted in Step 11	14	Modulation Analyzer Indication	≥ −3 dB	_____ dB	
AM Depth Funct. Gen. = 1 kHz	15	Maximum Modulation Depth	>90%	_____ %	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-15. Amplitude Modulation (Cont'd)					
		NOTE **Perform the following steps only when testing an HP 8340B.**			
8340B Freq. = 22 GHz					
AM Frequency Response	11	Note DVM Indication		_____ Vrms	
Funct. Gen. = 1 kHz	12	Flatness (read on Modulation		_____ dB	≤ ±0.2 dB
100 Hz	13	Analyzer)		_____ dB	≤ ±0.2 dB
200 Hz				_____ dB	≤ ±0.2 dB
500 Hz				_____ dB	≤ ±0.2 dB
2 kHz				_____ dB	≤ ±0.2 dB
5 kHz				_____ dB	≤ ±0.2 dB
10 kHz				_____ dB	≤ ±0.2 dB
AM Bandwidth Funct. Gen. = 100 kHz Adjust output level to that noted in Step 11	14	Modulation Analyzer Indication	≥ −3 dB	_____ dB	
AM Depth Funct. Gen. = 1 kHz	15	Maximum Modulation Depth	>90%	_____ %	

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-16. Frequency Modulation					
ACCURACY					
CW Freq. = 2.2 GHz					
FM Sensitivity = 1 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
FM Sensitivity = 10 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
CW Freq. = 2.5 GHz					
FM Sensitivity = 1 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
FM Sensitivity = 10 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
CW Freq. = 6.9 GHz					
FM Sensitivity = 1 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
FM Sensitivity = 10 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
CW Freq. = 13.4 GHz					
FM Sensitivity = 1 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
FM Sensitivity = 10 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
CW Freq. = 18 GHz					
FM Sensitivity = 1 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
FM Sensitivity = 10 MHz/V	7	V_{in} % Error		_____ V _____ %	 10%
FLATNESS					
FM Sensitivity = 1 MHz/V					
CW Freq. = 2.2 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 2.5 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 6.9 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 13.4 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 18 GHz	13	Worst Case Power Level		_____ dB	3 dB

SPECIFICATIONS TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-16. Frequency Modulation (Cont'd)					
FM Sensitivity = 10 MHz/V					
CW Freq. = 2.2 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 2.5 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 6.9 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 13.4 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 18 GHz	13	Worst Case Power Level		_____ dB	3 dB
CW Freq. = 20 GHz[1]	13	Worst Case Power Level		_____ dB	3 dB

1. Perform this step only when testing an HP 8340B.

OPERATING MANUAL

HP 8340A/B and HP 8341A/B ATTENUATOR CALIBRATION AND OPERATION VERIFICATION TEST SOFTWARE

For the HP 8340A/B and 8341A/B Synthesized Sweepers

HEWLETT PACKARD

HP 8340A/B AND HP 8341A/B ATTENUATOR CALIBRATION AND OPERATION VERIFICATION TEST SOFTWARE

REVISION A.02.00

This manual applies directly to the HP 8340A/B and HP 8341A/B Attenuator Calibration and Operation Verification Test Software, HP Part Number 08340-10009, revision A.02.00.

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MANUAL PART NO. 08340-90307
Microfiche Part Number 08340-90308

Printed: AUGUST 1986

HEWLETT PACKARD

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Chapter 1. General Information

1.0 Introduction

For your convenience, this supplement provides information to assist you in using the HP 8340A/B and 8341A/B Attenuator Calibration and Operation Verification Test Software, HP part number 08340-10009, provided with this document. The information begins with a general overview of the software, continues with the equipment required and modifications which can be made by the operator, and finally ends with how to run the tests.

1.1 Format of the Disc Containing the Software

The test software included with this documentation is being supplied on a double sided 3.5'' microfloppy. Any access to or copying of the programs on the software disc requires the use of a double sided 3.5'' microfloppy disc drive. Two examples of this type of disc drive are the 3.5'' floppy drive in the HP 9133H and the 3.5'' floppy drives in the HP 9122D.

1.2 Test Capability

The Attenuator Calibration and Operation Verification Test Software provides the capability to perform a semi-automated operation verification of the HP 8340A, 8341A, 8340B, and 8341B synthesized sweepers in addition to a complete calibration (adjust and test) of the 90 dB step attenuator included with many of the synthesizers.

The operation verification portion of the test software is intended to provide a 90% confidence level of the operation of the synthesizer. The operation verification is designed for use as an incoming inspection of the synthesizers or as a verification of instrument operation after an instrument repair. The performance tests provided in the operation verification are CW frequency accuracy, output power accuracy and flatness, and maximum leveled power. In addition, a phase lock loop diagnostic, an ALC accuracy verification, and a utility for displaying the internal calibration data are also provided.

The attenuator calibration portion of the test software provides the capability to adjust and verify the performance of the internal 90 dB step attenuator included with many of the synthesizers. In addition to this, a semi-automated performance test for the frequency switching time specification is provided. Both the 90 dB step attenuator adjustment and frequency switching time performance test can only be performed using the automated test supplied with this software. These tests should be used to supplement the manual adjustments and tests provided in the HP 8340A, 8341A, 8340B and 8341B operating and service manuals.

1.3 Test Record

Depending on the test which is performed, the test results will be presented in either tabular or graphical form. The test data includes test limits and the instrument's performance. During the testing, the operator is given a choice of either outputting the test data to the CRT of the system computer or to an external printer. Printed copies of the test data may be used as a permanent test record.

1.4 Make a Copy Before Use

Before running the test software or making any changes to the software's configuration, you should make a copy of the master disc supplied with this documentation. The master should then be stored in a safe place and the copy used for daily testing.

In order to make a copy of the master disc, you will need either two double sided 3.5" microfloppy disc drives or one fixed disc drive and one double sided 3.5" microfloppy disc drive. Two disc drives which may be used are the HP 9133H or the HP 9122D. In addition, the media on which the copy is made must be capable of storing the entire software (i.e., either another double sided 3.5 inch floppy or a fixed disc). The storage space requirements for this revision of software is approximately 650 kbytes.

When copying the software onto another 3.5 inch, double sided microfloppy, you must first initialize your blank floppy. When initializing your floppy, you must specify the interleave factor and also the format to be used during initialization. The required interleave factor is 2 and the required format is 3 (1024 bytes/sector). The initialize command you would execute from your computer's keyboard is as follows:

INITIALIZE "Address of the disc drive containing your blank floppy",2,3

An example would be: *INITIALIZE ":,700,1",2,3*. This would initialize a disc at HP-IB address 700, drive 1 and would set the disc's interleave factor to 2 and format to 1024 bytes/sector. If you do not initialize your blank 3.5 inch, double sided microfloppy in this manner, you will not have sufficient space on the disc to copy the software!

For your convenience, a copy program has been included on the master disc supplied with this document. This program allows you to copy the files on the master disc to either an initialized fixed disc or another 3.5" double sided floppy. When copying the master to another 3.5" floppy, insert the master disc into drive 0 of your double sided 3.5" disc drive and insert an initialized 3.5" floppy into drive 1. The name of the copy program is "Copy". After your floppy has been initialized, load the copy program "Copy" from the master disc and respond to the prompts provided. To ensure that you do not erase the programs on the master disc, you should Write Protect the master.

1.5 Anomaly Reporting

As with all software, an anomaly may occur. Notify the nearest Hewlett-Packard sales and service office when a software anomaly is observed. Use the software notification form located at the end of this manual.

1.6 Software Support Information

The software support provided by Hewlett-Packard for the HP 8340A/B and HP 8341A/B Attenuator Calibration and Operation Verification Test Software, HP P/N 08340-10009, is limited to the correction of anomalies found while using this test software with the test equipment recommended in Chapter 2 of this document. Any deviation from the equipment recommended in Chapter 2 will not be supported by Hewlett-Packard. In addition, the software modifications which the operator is allowed to perform is limited to the mass storage address, data storage address, and the test equipment address modifications described in Chapter 3 of this document. Modifications made to the software beyond those described in Chapter 3 will not be supported by Hewlett-Packard.

Chapter 2. Required Test Equipment

2.0 Introduction

This chapter provides a description of the test equipment and operating system requirements for the attenuation calibration and operation verification test software.

2.1 Technical Computer

Technical Computer: HP 9836A (HP 236) with > 1 megabyte of memory.

The Attenuator Calibration and Operation Verification software is also directly compatible with the HP 9816 (HP 216) and HP 9826 (HP 226) technical computers provided they also have > 1 megabyte of memory.

If you wish to use an HP 9000 Series 300 computer, the Attenuator Calibration and Operation Verification Software is compatible with the HP 98580A Option 008 system. This system includes an HP Model 310 (with 1 megabyte of memory), a 35731A monochrome monitor, a 46020A keyboard, Basic 4.0, and the 98546A video board for Series 200 display compatibility.

2.2 Disc Drive

Disc Drive: HP 9133H or HP 9122D

The critical requirements of the disc drive used to run the Attenuator Calibration and Operation Verification Software is that the disc drive media be capable of storing > 650 kbytes of information on one disc and that the disc drive is compatible with the HP 9000 Series 200 or Series 300 technical computer you are using.

The HP 9122D is recommended because of its low cost and the convenience provided by the dual, double sided 3.5'' floppy disc drives. The HP 9122D provides full compatibility with the Attenuator Calibration and Operation Verification Software in addition to the convenience of running the test software and storing the test data on the same type of media. The HP 9122D also simplifies the task of making a working copy of the test software.

The HP 9133H is recommended because it provides additional storage capability for other software you may have, allows convenient storage of the test data on either the fixed disc or a 3.5'' floppy and also simplifies the task of making a working copy of the test software.

For some additional information regarding mass storage and data storage requirements, refer to paragraph 3.1.

2.3 Operating System

Operating System: **HP Basic 3.0** and the HP Basic 3.0 binary extensions listed below or **HP Basic 4.0** and the HP Basic 4.0 binary extensions listed below. If you are using the Series 300 computer recommended in paragraph 2.1, you must use HP Basic 4.0.

Name	Description
GRAPH	Graphics
GRAPHX	Graphics Extensions
IO	I/O
MAT	Matrix Statements
KBD	Keyboard Extensions
CLOCK	Clock
MS	Mass Storage
ERR	Error Messages
CS80	CS80 Disc Driver
HPIB	HP-IB Interface Driver

Note that when HP Basic 3.0 or 4.0 is loaded into your technical computer's memory, the binary extensions must also be loaded. The binary extensions can either be loaded by using the "LOAD BIN" command or by configuring your HP Basic 3.0 or 4.0 operating system to include the binary extensions (this is the most convenient way). For more information regarding configuring an operating system, refer to your HP Basic 3.0 or 4.0 User's Guide under the heading "Configuring Basic Systems".

2.4 Test Equipment

Local Oscillator[1]	HP 8340A Option H01 or HP 8340A/B Option 001
Spectrum Analyzer[1]	HP 3585A
Frequency Counter[2]	HP 5343A Option 011
Power Meter	HP 436A Option 022
Power Sensor	HP 8481A
Power Sensor	HP 8485A
Universal Counter[1]	HP 5316A
Amplifier[1]	HP 8447F
Step Attenuator (calibrated at 1 MHz)[1]	HP 355D
Printer	HP 2673A or HP 2225A
Attenuator (10 dB)[1]	HP 8493C Option 010
Attenuator (20 dB)	HP 8493C Option 020
Mixer[1]	HP P/N 0955-0307
Low Pass Filter[1]	HP P/N 9135-0260

1. Required for the Attenuator Calibration Tests only.
2. Required for the Operation Verification Tests only.

Adapters:

APC 3.5 (f) to APC 3.5 (f) (2 required)	HP P/N 5061-5311
APC 3.5 (f) to Type N (m)	HP P/N 1250-1744
APC 3.5 (f) to Type N (f)[3]	HP P/N 1250-1745
SMA (m) to BNC (f).	HP P/N 1250-1200
Type N (m) to BNC (f)[2]	HP P/N 1250-0780

Cables:

Semi-rigid coax, SMA(m) to SMA (m)	HP P/N 08340-20124
BNC (m) to BNC (m) (7 required)	HP P/N 8120-1840
3.5 inch Diskettes (Box of 10)	HP 92192A

In addition, a minimum of 5 HP-IB cables will be required to run the tests (includes connection to disc drive and printer).

1. Required for the Attenuator Calibration Tests only.
2. Required for the Operation Verification Tests only.
3. Required for testing an HP 8340A/B only.

Chapter 3. How to Configure the Software

3.0 Introduction

This chapter describes the mass storage and data storage requirements, addressing, and the modifications which are allowed for configuring the software to match you mass storage and data storage devices. Also described is the HP-IB addressing of the test equipment and what modifications can be made.

3.1 Mass Storage and Data Storage Requirements

Mass storage in this document refers to the storage location of the test software and the location of the user generated calibration data files (described in Chapter 6). The test software includes all of the program files and data files supplied on the Attenuator Calibration and Operation Verification disc (with the exception of "Copy"). The total mass storage requirement is 650 kbytes. With this mass storage requirement, the disc drives which may be used are limited to a double sided 3.5" microfloppy disc drive (700 kbytes storage capability per floppy disc) or a fixed disc drive with > 650 kbytes of storage capability.

Data storage in this document refers to the storage location of the test result data files. All of the tests (with the exception of CW frequency accuracy and loop thrasher) store the test result data onto the designated data storage device. The data storage requirements per instrument is approximately 15 kbytes.

3.2 Mass Storage and Data Storage Addressing

The software comes configured for immediate use on an HP 9122D which is set to HP-IB address 700 or on an HP 9133H which is configured for one volume and is set to HP-IB address 700. With either of these disc drives, the mass storage device is drive 0 and the data storage device is drive 1. For your convenience, the appropriate switch settings and some other additional information about the disc drive configuration is provided in the next two paragraphs.

HP 9122D – Set to HP-IB address 700 (the HP 9122D's HP-IB DIP switch is set up with switch 1 up and switches 2, 3, and 4 down). When using the HP 9122D, the test software disc is placed in drive 0 (left hand drive, HP-IB address ":,700,0") and an initialized disc, which will be used for test data storage, is placed in drive 1 (right hand drive, HP-IB address ":,700,1").

HP 9133H – Set to HP-IB address 700 (make sure the thumbwheel on the rear panel is set to 0). Set the HP 9133H's rear panel configuration dial to 0 or 1. Make sure the hard disc drive (drive 0) is initialized and has either HP BASIC 3.0 or 4.0 loaded along with the binary extensions mentioned earlier. As mentioned in paragraph 2.3, Operating System, the binary extensions should be part of the HP Basic 3.0 or 4.0 operating system. When using the HP 9133H, the test software is located in drive 0 (fixed disc drive, HP-IB address ":,700,0") and an initialized disc, which will be used for test data storage, is placed in drive 1 (floppy disc drive, HP-IB address ":,700,1"). For more information regarding the initialization and addressing of the HP 9133H, refer to the "Using Your HP 9133H Disc Drive" manual supplied with the HP 9133H. The chapter you need to refer to is Using Your HP 9133H With Series 200 BASIC 3.0.

The software comes already configured for either of the disc drives listed above (provided the disc drive settings are as shown). If you wish to use a different HP-IB address for the disc drive or select a different number of volumes on the HP 9133H (above configuration dial setting selects one volume), you must modify a few lines of code in the software in order for the software to run. Paragraph 3.3 provides the details on modifying the software. If you use the settings listed above, no modification is required.

3.3 Modifying Mass Storage and Data Storage Addressing

Six system variables located in the overhead program FS_MANAGER, subprogram Mass_stg_init, are used to define three addresses (storage locations); one address for the test software, one for the test result data files, and one for the user generated calibration data files (described in Chapter 6). Each address requires two system variables; the first system variable is used for the directory pointer and the second for the mass storage unit specifier. Table 1 lists the six system variables, what address they define, and what type of system variable they are. Figure 1 provides a listing of the subprogram Mass_stg_init which shows the current configuration of the system variables and their location. The balance of this section describes the use of the directory pointer and the mass storage unit specifier in this software and should give some insight as to what changes would need to be made to the system variables to accommodate different storage media. The descriptions supplied assume that you are familiar with the operation of your disc drive. Before making any changes, you should read through the directory pointer and mass storage unit specifier descriptions in this section and determine what modifications need to be made. When you are ready to perform the modification, you should then read PERFORMING THE MODIFICATION at the end of this section.

Table 1. System Variables

Name	Address Defined	System Variable Type
Manager_sys$	Test Software	Directory Pointer
Msus$	Test Software	Mass Storage Unit Specifier
Dut_dir$	Test Result Data Files	Directory Pointer
Dut_msus$	Test Result Data Files	Mass Storage Unit Specifier
Calfactor_dir$	Calibration Data Files	Directory Pointer
Cf_msus$	Calibration Data Files	Mass Storage Unit Specifier

DIRECTORY POINTER DESCRIPTION

The following describes the use of the directory pointer in the test software. Although Manager_sys$ is referred to specifically, the description regarding the usage of the directory pointer applies to all three directory pointers.

Manager_sys$ defines the directory pointer for the test software. Since the HP 9133H and 9122D do not use directories for organizing information on the disc, the directory pointer, Manager_sys$, is set to the null string in the program (i.e., Manager_sys$=""). For a disc drive which uses directories and thus requires the directory pointer to be defined, Manager_sys$ should be changed to reflect the label of the directory where the test software is stored.

Example: Manager_sys$="/8340TEST/" or Manager_sys$="/APPLIC/8340TEST/").

Note that the slashes required for the directory pointer are included on both ends.

MASS STORAGE UNIT SPECIFIER DESCRIPTION

The following describes the use of the mass storage unit specifier in the test software. Although Msus$ is referred to specifically, the description regarding the usage of the mass storage unit specifier applies to all three mass storage unit specifiers.

Msus$ is the mass storage unit specifier which defines the address for the test software. When using an HP 9133H set to one volume and HP-IB address 700 or an HP 9122D set to HP-IB address 700, Msus$ would be set as follows: Msus$="":,700,0". This designates drive 0 as the storage location for the test software. When using other disc drives or another address, you would need to set Msus$ to reflect the address of you disc drive. Two examples could be; Msus$="":REMOTE 21,3" (when using a shared resource management system) or Msus$="":,700,0,0" (when using an HP 9133H set to more than one volume).

PERFORMING THE MODIFICATION

After you have determined the modifications which need to be made to the system variables, you should perform the following.

1. Bootup HP Basic 3.0 or 4.0 with the appropriate binary extensions needed to operate your system. If using an HP 9133H or 9122D, the binary extensions listed in paragraph 2.3 are all you need.
2. LOAD "FS_MANAGER".
3. EDIT Mass_stg_init.
4. Scroll to the system variables which need to be modified and make the appropriate changes. Enter each line after modifying.
5. Check the system variables to ensure that the modifications you made are correct.
6. If the storage media you are using for the test software is a double sided 3.5" microfloppy, you will need to PURGE "FS_MANAGER".
7. RE-STORE "FS_MANAGER".

```
1283 Mass_stg_init:!
1284  !-----------------------------------------------------------------!
1285  !  FIELD SERVICE VERSION -- assumes HP 9133H or HP 9122D
1286  !
1288  !-----------------------------------------------------------------!
1289  !  This subprogram must initialize the variables for a particular
1290  !  implementation of 'MANAGER'.
1291  !-----------------------------------------------------------------!
1292     COM /Mass_storage/ Manager_sys$,Menu_storage$
1293     COM /Mass_storage/ Dir_pointer$,Msus$
1294     COM /Dut_storage/ Dut_dir$[50],Dut_msus$[50]
1295     COM /Janitor_mode/ Jan_mode$[12]
1296     COM /Calfactor_strg/ Calfactor_dir$[50],Cf_msus$[30]
1297     COM /Config/ Mass_stg_sys$[30]
1298     COM /Enhancements/ On$[1],Off$[1],Flash$[1]
1299     COM /Keyboard/ INTEGER Hil_keyboard
1300  !
1301  !  Manager_sys$      Directory pointer for System program files.
1302  !  Menu_storage$     Directory pointer Menu files.
1303  !  Dir_pointer$      Directory pointer for Subsystem data files.(NOT USED)
1304  !  Msus$             Mass storage unit specifer for menu's and subsystems
1305  !  Dut_dir$          Directory pointer for DUT data files
1306  !  Dut_msus$         Mass storage specifier for DUT data files
1307  !  Calfactor_dir$    Directory pointer for test system cal files
1308  !  Cf_msus$          Mass storage specifier for cal files
1309  !  Mass_stg_sys$     Mass storage system specifier('HARD DISC' or 'FLOPPY')
1310  !  On$               Display enhancement to turn inverse video ON
1311  !  Off$              Display enhancement to turn enhancement OFF
1312  !  Flash$            Display enhancement to turn flashing ON
1313  !-----------------------------------------------------------------!
1314     Manager_sys$=""
1315     Menu_storage$=Manager_sys$
1316     Dir_pointer$=Manager_sys$
1317     Msus$=":,700,0"
1318     !
1319     Dut_dir$=""
1320     Dut_msus$=":,700,1"
1321     !
1322     Calfactor_dir$="Manager_sys$"
1323     Cf_msus$=Msus$
1324     !
```

Figure 1. Program Listing, Mass_stg_init

3.4 HP-IB Addresses of the Test Equipment

The Attenuator Calibration and Operation Verification test software has been written to drive specific HP-IB test equipment. Although the test equipment which is required can not be changed, the HP-IB addresses for the test equipment can be modified. Table 2 below lists the test equipment with HP-IB and the equipment's HP-IB addresses. Use of the HP-IB addresses shown below will not require any modification of the software. If you wish to use different addresses than shown, you will need to modify the software. For the HP-IB address modification procedure, refer to paragraph 3.5.

Table 2. HP-IB Address Settings for the Test Equipment

Model Number	Description	HP-IB Address
HP 2673A or 2225A	Printer	01
HP 5343A	Frequency Counter	02
HP 3585A	Spectrum Analyzer	11
HP 436A	Power Meter	13
HP 5316A	Universal Counter	16
HP 8340A/B or 8341A/B	Device Under Test	19
HP 8340A/B	Local Oscillator	20

3.5 Modifying the HP-IB Addresses of the Test Equipment

Located in the overhead program FS_MANAGER, subprogram Asgn_test_equip, are the assignments of the HP-IB addresses for the test equipment used in the test software. Figure 2 provides a listing of the subprogram Asgn_test_equip and the current HP-IB address assignments. Included in the test equipment assignments are some additional pieces of test equipment which are not needed to run the HP 8340A/B and HP 8341A/B Attenuator Calibration and Operation Verification Test Software. You only need to modify the HP-IB address assignments for the test equipment listed in Table 2. The procedure for modifying the test equipment's HP-IB address assignments is described below in PERFORMING THE MODIFICATION.

```
3460 Asgn_test_equip: !
3461  ! ---------------------------------------------------------------!
3462  !  This subprogram assigns addresses to the I/O path names in the
3463  !  /Hpib_codes/ common block.
3464  ! ---------------------------------------------------------------!
3465     COM /Hpib_codes/ @Dut,@Hfsa,@Lfsa,@Cntr,@Pwrmtr,@Dvm
3466     COM /Hpib_codes/ @Fun_gen,@Rf_gen,@Het,@Mod_an,@Atn_drv
3467     COM /Hpib_codes/ @Timer,@Pulse_gen,@Pwr_supply,@D15,@D16
3468  !---------------------------------------------------------------!
3469     COM /Peripherals/ INTEGER Prntr,Key_bd,Screen
3470  !---------------------------------------------------------------!
3471     COM /Equipment/ Dvm$[6],Mod_an$[6]
3472  !---------------------------------------------------------------!
3473     ASSIGN @Dut TO 719       ! HP 8340A OR 8341A UNDER TEST
3474     ASSIGN @Hfsa TO 718      ! HP 8566A OR 8566B SPECTRUM ANALYZER
3475     ASSIGN @Lfsa TO 711      ! HP 3585A SPECTRUM ANALYZER
3476     ASSIGN @Cntr TO 702      ! HP 5343A FREQUENCY COUNTER
3477     ASSIGN @Pwrmtr TO 713    ! HP 436A POWER METER
3478     ASSIGN @Dvm TO 722       ! HP 3455A OR 3456A DIGITAL VOLTMETER
3479     ASSIGN @Fun_gen TO 705   ! HP 3325A FUNCTION GENERATOR
3480     ASSIGN @Rf_gen TO 717    ! HP 8662A RF SYNTHESIZER
3481     ASSIGN @Het TO 720       ! HP 8340A LOCAL OSCILLATQR
3482     ASSIGN @Mod_an TO 714    ! HP 8901A OR 8902A MODULATION ANALYZER
3483     ASSIGN @Atn_drv TO 712   ! HP 11713A ATTENUATOR/RELAY DRIVER
3484     ASSIGN @Timer TO 716     ! HP 5316A COUNTER/TIMER
3485     ASSIGN @Pulse_gen TO 706
3486     ASSIGN @Pwr_supply TO 707
3487     ASSIGN @Scope TO 708     ! 54110D DIGITIZING OSCILLOSCOPE
3488     !
3489     ! @D16                   ! SPARE
3490     !
3491     Prntr=701
3492     Key_bd=2
3493     Screen=1
3494     !
```

Figure 2. Program Listing, Asgn_Test_Equip

PERFORMING THE MODIFICATION

After you have determined the modifications which need to be made to the HP-IB addresses, you should perform the following.

1. Bootup HP Basic 3.0 or 4.0 with the appropriate binary extensions needed to operate your system. If using an HP 9133H or 9122D, the binary extensions listed in paragraph 2.3 are all you need.

2. LOAD "FS_MANAGER".

3. EDIT Asgn_test_equip.

4. Scroll to the line which ASSIGNs the address to the instrument you wish to modify. Make the address change and ENTER the line. An example of a possible modification would be to change the device under test's HP-IB address assignment to 30. To do this, you would scroll to the "ASSIGN @Dut TO 719" line and change 719 to 730. After making the change, you would press ENTER on your computer's keyboard.

5. Check the HP-IB assignments to ensure that the modifications you made are correct. Also check that there are no duplicate addresses!

6. If the storage media you are using for the test software is a double sided 3.5" microfloppy, you will need to PURGE "FS_MANAGER".

7. RE-STORE "FS_MANAGER".

Chapter 4. Test Dependency

4.0 Introduction

Two types of test capability are provided in the HP 8340A/B and HP 8341A/B Attenuator Calibration and Operation Verification test software. You may either perform a calibration of the internal 90 dB step attenuator or you may perform an operation verification of the synthesizer. A listing of the individual tests provided is shown by category in Table 3.

Table 3. Listing of Tests

Operation Verification	Attenuator Calibration
Cal Constants Phase Lock Diagnostics CW Frequency Accuracy ALC Accuracy Output Power Accuracy Maximum Leveled Power	Output Power Accuracy RF Attenuator Calibrate Frequency Switching Time Cal Constants

Some of the tests require that the user generated calibration data for the HP 8485A power sensor and the HP 355D step attenuator (IF Attenuator) be resident on the disc assigned to hold this information. In addition to this requirement, some of the tests must be run in sequence to allow the test result data from a previous test to be used for a latter test. Paragraph 4.1 provides a Test Dependency Flow Chart which shows the hierarchy of the tests. Chapter 3 provides information regarding the software's mass and data storage addressing (i.e., on which disc the user generated calibration data and the test result data will be resident).

4.1 Test Dependency Flow Chart

The flow chart in Figure 3 shows the test interdependency. The tests and utilities included in Level 1 of the flow chart can be run independently and in any order. As shown in Level 2, the Power Sensor Cal must be run before performing the Output Power Accuracy test. Finally, as shown in Level 3, Maximum Leveled Power is dependent upon Output Power Accuracy and the Attenuator Calibration is dependent upon both Output Power Accuracy and the IF Attenuator Cal. The flow chart in Figure 3 applies to both the operation verification and calibration portions of the software.

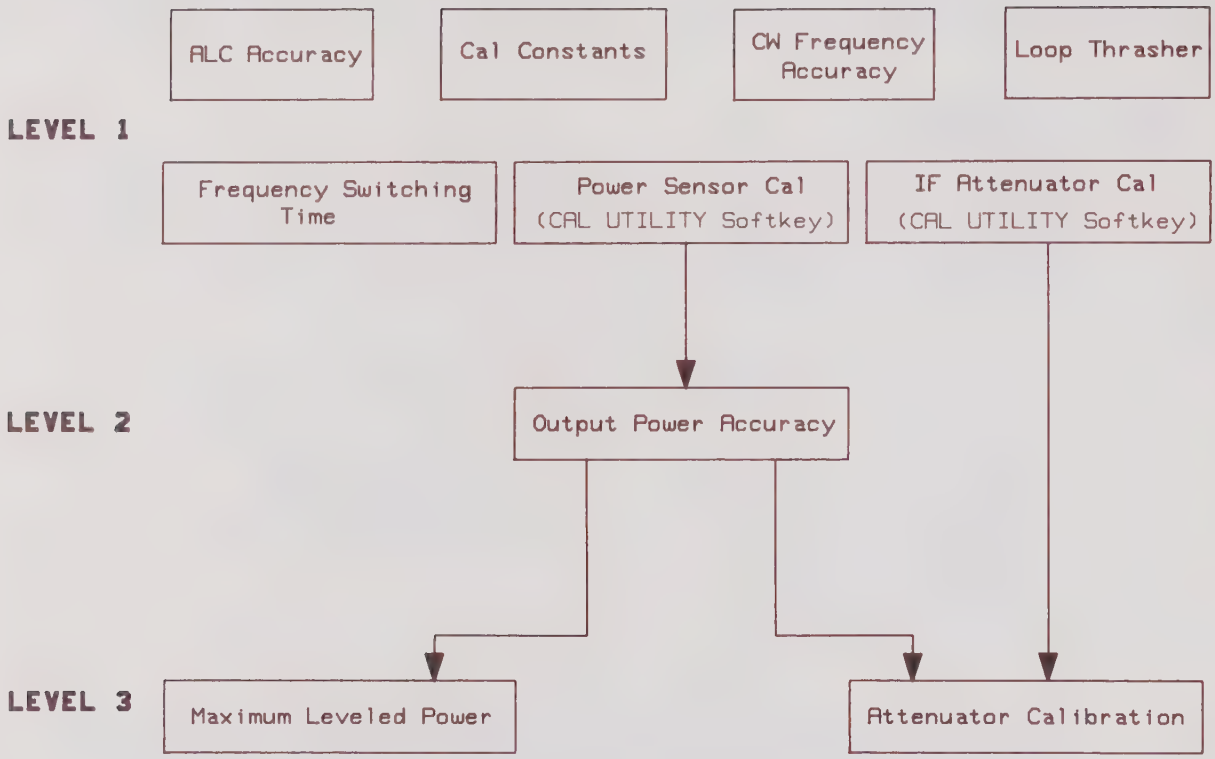

Figure 3. Test Dependency Flow Chart

Chapter 5. Running the Software

5.0 Introduction

This chapter explains how to boot up the HP 8340A/B and HP 8341A/B test software and also provides a description of the 8340 FAMILY TEST SYSTEM menu.

5.1 System Setup

Figure 4 provides the system setup required to run the HP 8340A/B and HP 8341A/B Attenuator Calibration and Operation Verification Software. Since the computer, disc drive, and printer are common to all of the tests and utilities, they will not be repeated in the individual test setups.

The individual test setups for the tests and utilities assume that all HP-IB connections have been made to the computer, disc drive, DUT and the test equipment with HP-IB. These connections will not be shown in the individual test setups.

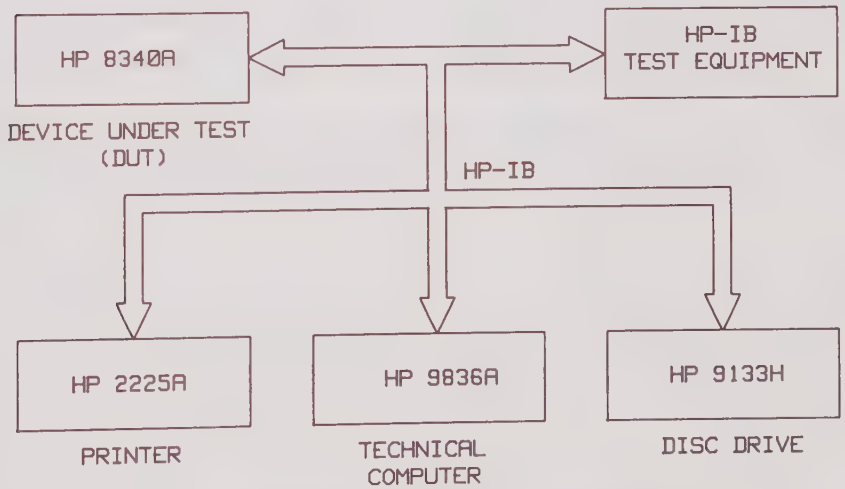

Figure 4. System Setup

5.2 Booting Up the Software

To boot up the test software, perform the following steps:

1. Load into your computer HP Basic 3.0 or 4.0 and the binary extensions listed in paragraph 2.3, Operating System.

2. Insert an initialized disc into the disc drive which you have designated as the data storage device (using unmodified software and an HP 9122D or 9133H this will be drive 1). After running a test, the software will automatically access the data disc and store the test data. One data disc can be used for multiple instruments. If you decide to use one data disc for multiple instruments, it is recommended that you maintain a separate data disc for your HP 8340As, HP 8340Bs, HP 8341As, and HP 8341Bs. The reason for this is that the software keys on the last four digits of the serial number when storing data and does not distinguish between the different models. If you happen to have two different models with the same ending four digits, the software may write over a data file you wish to retain.

3. Connect your Device Under Test (DUT) to the test system's HP-IB.

4. Type **LOAD "FS_MANAGER"**, press **ENTER** and then **RUN**.

5. If the Series 200 or 300 computer has been disconnected from ac power, the program will ask you to enter the date and the time in the format shown on the screen. The date and time will be printed on the data output of each test you run. Skip this step if the computer does not ask for date and time.

6. You have now arrived at the 8340 FAMILY TEST SYSTEM menu. The choices offered are testing an HP 8340A, 8341A, 8340A Option H02, HP 8340B, HP 8341B, or running the Cal (Calibration) Utilities. To determine if you first must run the Cal Utilities, refer to Chapter 4, Test Dependency.

   After you have selected the test path you wish, refer to either Chapter 6, Running the Cal Utilities, or Chapter 7, Testing an HP 8340A/B or HP 8341A/B.

Chapter 6. Running the Cal Utilities

6.0 Introduction

The Cal Utilities portion of the software is provided to assist the operator in generating a calibration data file for the specific HP 355D step attenuator and HP 8485A power sensor being used during the tests. As mentioned in Chapter 4, Test Dependency, several of the tests require the use of the data stored in these data files before they can be run. The data files generated by the operator are stored and accessed on the storage media whose address is defined by Calfactor_dir$ and Cf_msus$ (discussed in Chapter 3). When using unmodified software and either an HP 9122D or 9133H, the data is located on drive 0.

Before running the Cal Utilities, you should obtain the calibration data for the attenuator and power sensor you will be using during the tests. Once the data is obtained, you can proceed with the appropriate utility. Upon completion of the utility, the data you entered will be stored. The only time you will need to re-run the Cal Utilities is when the attenuator or power sensor is re-calibrated or if you are using a device for which you have not yet entered data.

To run the Cal Utilities, press the **Cal Utility** softkey. You will then be given a choice of entering the attenuator's calibration data (**IF Attenuator** softkey) or the power sensor's calibration data (**Pwr Sensor Cal** softkey). The **Exit** softkey will return you to the 8340 FAMILY TEST SYSTEM menu. Make your selection and proceed to the appropriate entry paragraph below.

6.1 Entry of the IF Attenuator's (HP 355D) Calibration Data

Press the **IF Attenuator** softkey to begin entry of the attenuator's calibration data. A softkey menu which provides you the options of **Start** or **Return** will be displayed. Press the **Start** softkey to begin entry of the calibration data or the **Return** softkey to return to the CALIBRATION UTILITIES menu.

When the **Start** softkey is selected, the program will request the serial number of the attenuator and then the actual value of attenuation for the 10 dB through 70 dB steps. When entering the attenuator step values, enter the actual value (i.e., if the 10 db step is 10.02, enter 10.02). Also, the values entered should be positive. After entering all of the data, you will be given the opportunity to make corrections if necessary. Answer the rest of the questions supplied in the program and then press **Return** to return to the CALIBRATION UTILITIES menu.

6.2 Entry of the Power Sensor's (HP 8485A) Calibration Data

Press the **Pwr Sensor Cal** softkey to begin entry of the power sensor's calibration data. A softkey menu which provides you the options of **Start** or **Return** will be displayed. Press the **Start** softkey to begin entry of the calibration data or the **Return** softkey to return to the CALIBRATION UTILITIES menu. Before pressing the **Start** softkey, perform the 10 MHz Calibration Procedure described in paragraph 6.3.

When the **Start** softkey is selected, the program will request the serial number of the power sensor and then the Cal Factors for each sensor data point. The 10 MHz data point entry should be the value determined in paragraph 6.3. After entering all of the data, you will be given the opportunity to make corrections if necessary. When making a correction, enter the frequency in error as shown in the "Freq" column and then enter the correct value. Answer the rest of the questions supplied in the program and then press **Return** to return to the CALIBRATION UTILITIES menu.

6.3 10 MHz Calibration Procedure

Equipment Required:

Power Meter	HP 436A Option 022
Power Sensor	HP 8481A
Power Sensor	HP 8485A
Adapters:	
APC 3.5 (f) to APC 3.5 (f)[1]	HP P/N 5061-5311
APC 3.5 (f) to Type N (m)	HP P/N 1250-1744
APC 3.5 (f) to Type N (f)[1]	HP P/N 1250-1745

1. Connect the HP 8481A power sensor to the power meter. Allow at least one half hour for warm up. Set the power meter's calibration factor switch to include 10 MHz, then zero and calibrate the power meter before connecting the power sensor to the DUT.

2. Connect the HP 8481A power sensor to the DUT's RF output.

3. On the DUT, press **[INSTR PRESET][CW][1][0][MHz].** Press **[RF]** OFF. Zero the power meter. Press the DUT's **[RF]** key ON. On the DUT, press **[POWER LEVEL]**. Using the rotary knob, adjust the DUT's output power to obtain a 1.0 milliwatt indication on the power meter.

4. Disconnect the HP 8481A power sensor from the DUT. Turn the power meter's line switch OFF and replace the HP 8481A with the HP 8485A power sensor. Turn the power meter's line switch back on and allow 15 minutes for the sensor to stabilize. Zero and calibrate the power meter.

5. Press the DUT's **[RF]** OFF. Connect the HP 8485A power sensor to the DUT.

6. Zero the power meter and then press the DUT's **[RF]** ON. Adjust the power meter's calibration factor dial for a power meter indication of 1.0 milliwatt. The power meter calibration factor setting is the Cal Factor % which should be entered for the HP 8485A's 10 MHz data point.

1. Required for an HP 8340A/B DUT only.

Chapter 7. Testing an HP 8340A/B or HP 8341A/B

7.0 Introduction

Whether you are testing an HP 8340A/B or HP 8341A/B, the tests which may be run and the flow of the test software are the same. Since this is the case, this chapter will discuss the flow of the test software from the 8340 FAMILY TEST SYSTEM menu to the test menu (either the Operation Verification menu or the Attenuator Calibration menu). This chapter will not differentiate between testing an HP 8340A/B or HP 8341A/B. Once you are ready to run a specific test, you should proceed to the chapter which discusses the test you wish to run.

7.1 Selecting the Type of Testing

After you have selected the appropriate softkey, **Test8340A**, **Test8341A**, **TestH02** (HP 8340A Option H02), **Test8340B**, or **Test8341B**, you will be given a choice of performing an Operation Verification (**OpVer**) or Attenuator Calibration (**Cal**). For either type of testing you select, the program will proceed as follows.

1. The computer will tell you the model number and serial number it read from the instrument's Calibration Constants and ask you to verify that they are correct. If the number obtained is incorrect you will need to verify the instrument's calibration data using the hard copy of the calibration data located underneath the DUT's top cover. Otherwise, select **YES**.

2. The computer will now read the rest of the instrument's Calibration Constants. If the computer now offers the **Menu** softkey, go directly to step 3.

   CALIBRATION CONSTANT DISCREPANCIES

   If there is a Cal Constants data file for this instrument on the data disc, and the file does not match the Cal Constants in the instrument, the computer will display the following:

   DUT CAL *#Cal Constant Name* = ### BUT FILE = ###

   [DUT OK] **[NEITHER]** **[FILE OK]**

The most common reason for this screen to be displayed is that someone has pressed **[SHIFT] [PEAK]** on the synthesizer. This function causes the synthesizer to automatically optimize its RF output power and to update the YTM GAIN, YTM OFFSET, and the YTM BX GAIN Cal Constants. If the Cal Constant being displayed is one of those listed above, and the synthesizer does not have a front panel failure annunciator on, it is likely that the Cal Constant in the DUT is OK. In any case, it is up to the operator to determine which of the Cal Constants is valid (one method is by examining the printed copy of the Cal Constants located underneath the synthesizer's top cover) or to assume that the data disk (file) is OK.

Press the appropriate softkey in response to the prompt. If **NEITHER** is selected, you will need to enter the correct value for the Cal Constant. After all Cal Constant discrepancies are taken care of, the program will return to normal operation.

3. Enter the DUT's serial prefix number. (This is the first five alpha-numeric characters in the instrument's serial number (i.e., 2231A). If test data for this instrument exists on the current data disc (from previously run tests), the computer won't ask for the serial prefix number.

4. Enter the DUT's option configuration. Refer to the serial tag on the rear panel of the DUT and one at a time, enter the three digit option numbers shown on the serial tag (many instruments only have one option, or none at all). Once all the options have been entered, press enter. If the instrument is a standard (i.e., no options listed), just press enter. If test data for this instrument exists on the current data disc (from previously run tests), the computer will not ask for option information.

5. If the option information had to be entered in step 4, the computer will now display the options that were entered (000 will be displayed if no options were entered). If the list is correct, press **Yes**, if not, press **No** and re-enter the option configuration when prompted.

6. The software will now give you a choice of the following:

   Menu – Allows you to access the test menu for the type of testing you selected (i.e., either Operation Verification or Attenuator Calibration).

   New DUT – Tells the software that you have connected a different DUT to the HP-IB. Note that if the model number of the new DUT is not the same as the previous one, the program will automatically return you to the 8340 FAMILY TEST SYSTEM menu.

7. If **Menu** is selected, the test menu name and the tests which may be run will be displayed. At this point, select the appropriate softkey. You have the following choices:

   Input # – Allows you to enter the specific test number you wish to run.

   Auto Sequence – The auto sequence menu allows you to select which tests to run automatically. When the tests are selected (**ON** or **All on** softkey and then the **Execute** softkey are pressed), the program will automatically load the first test. At the end of each test, the next test will then be loaded. This feature saves having to return to the test menu after each test.

   LoopTest – Allows you to run the selected test (test the cursor is pointing to) however many times you wish. The cursor position can be changed by using the rotary control knob on the keyboard or the up/down keys.

   PrevPage – Not implemented on this version of software.

   Utility – Allows you to access the Test Menu Utilities (see Chapter 16 for detailed information on how to use the utilities described below). The Utilities which you may choose from are as follows:

   * Change the option configuration Cal Constants in the DUT (used when retrofitting options).

   * Display or print the data from any of the tests you have run.

   * Display or print the test status for any instrument you have tested.

SELECT – Selects the test to which the cursor is pointing. The cursor position can be changed by using the rotary control knob on the keyboard or the up/down keys.

NextTest – Automatically selects the next test to be run.

NextPage – Not implemented on this version of software.

Exit – Exits you from this menu.

8. Select the desired test or utility and refer to the appropriate chapter. See Table 4.

Table 4. Chapters Containing Test/Utility Descriptions

Test/Utility	Chapter
Calibration Constants	8
Phase Lock Diagnostics	9
CW Frequency Accuracy	10
ALC Accuracy	11
Output Power Accuracy	12
Maximum Leveled Power	13
RF Attenuator Calibration	14
Frequency Switching Time	15
Test Utilities	16

Chapter 8. Calibration Constants Utility

8.0 Description

This program is not a test in that it does not verify conformance to a specification. Rather it is a utility program which allows the operator to manipulate the Calibration Constants in the instrument or in the data disc file. Calibration Constants either from the instrument or data disc may be viewed or printed; Cal Constants may be transferred from the instrument onto the data disc (image file), or vice versa; or the Cal Constants in an image file may be compared with those in the instrument.

8.1 Test Equipment

None required.

8.2 Procedure

1. The softkeys provided for this utility are as follows:

   COMPARE – Compares current instrument Cal Constants with the image file. This is the key you should select to meet the requirements for the operation verification.

   ReadDUT – Reads the DUT's Cal Constants into the computer's memory.

   GetFILE – Loads the Cal Constant image file for the DUT into the computer's memory.

   EXIT – Return to the test menu.

   Select the desired softkey.

2. After any of the above three selections are made, the program will offer the following additional softkeys:

   PRINT – Prints the Cal Constants currently in the computer's memory.

   DISPLAY – Displays the Cal Constants currently in memory.

   Wrt DUT – Writes the Cal Constants in the computer's memory to the instrument's WORKING Cal Constant memory and then stores the Cal Constants into the instrument's PROTECTED Cal Constant memory.

   SavFILE – Takes the Cal Constants in the computer's memory and creates a permanent image file on the data disc.

   Select the desired softkey and respond to any prompts provided by the program.

Chapter 9. Phase Lock Diagnostics

9.0 Description

This program is not a test in that it does not verify conformance to a specification. Rather it is a diagnostic which tests the integrity of the internal phase lock loops. The diagnostic causes the phase lock loop frequency to be switched very rapidly from one extreme to the next. During this process, the synthesizer is polled for an unlock indication to determine if phase lock has been lost. If at any point during the test an unlock indication is detected, the diagnostic will indicate which phase lock loop was unlocked.

9.1 Test Equipment

None required.

9.2 Procedure

1. The softkeys provided for this diagnostic are as follows:

   THRASH – Runs the diagnostic. This is the key you should select to meet the requirements for the operation verification.

   JANITOR – Returns you to the test menu.

   Select the desired softkey.

Chapter 10. CW Frequency Accuracy Test

10.0 Description

The synthesizer's RF output is connected to a frequency counter. The frequency counter's internal time base is used as the reference for the synthesizer to eliminate time base error from the measurement. The synthesizer's display and the counter's display should agree, within the resolution of each instrument. This procedure does not test for CW frequency accuracy as a function of the time base accuracy.

In the following test, the test frequencies are selected to exercise each frequency related circuit throughout the synthesizer while holding all remaining circuits constant. The test frequencies are grouped so that an abnormal indication would point to the circuit most likely causing the problem. Once this test is completed, the endpoint accuracy of the synthesizer is tested.

10.1 Test Equipment

Frequency Counter	HP 5343A Option 011
Cables:	
Semi-rigid coax, SMA (m) to SMA (m)	HP P/N 08340-20124
BNC (m) to BNC (m), (2 required)	HP P/N 8120-1840
Adapters:	
APC 3.5 (f) to APC 3.5 (f), (2 Required)	HP P/N 5061-5311
SMA (m) to BNC (f)	HP P/N 1250-1200
Type N (m) to SMA (f)[1]	HP P/N 1250-1250

1. Required for an HP 8341A/B DUT only.

10.2 Procedure

1. The softkeys provided for this test are as follows:

Setup	– Provides a graphical display of the CW Frequency Accuracy Test setup on the CRT.
M/N	– Test the M/N phase lock loop only.
20/30	– Test the 20/30 phase lock loops only.
ENDPNT ACCY	– Test the synthesizer's frequency endpoints and the YIG oscillator's frequency endpoints.
ALL	– Test all of the above. This is the key you should select to meet the requirements of the operation verification.
Print	– Must be pressed before each test is run to obtain a printout of the test data. No data is stored for this test.
DONE	– Return to the test menu.

Select the desired softkey and respond to any prompts provided by the program. In order to get the test menu STATUS to indicate PASS, all three of the above test must be run and pass.

2. If a test should fail, the program will pause and give you a softkey choice of:

CONT.	– Proceed with the next step of the test.
REPEAT	– Repeat the test that was run.
ABORT	– Return to the softkey menu in step 1.

Select the desired softkey and respond to any prompts provided by the program.

Chapter 11. ALC Accuracy Verification

11.0 Description

This program is not a test in that it does not verify conformance to a specification. Rather it is a verification of the operation of the automatic leveling control (ALC) circuitry. This verification is used to alert the operator to any problems which may exist in the ALC. A problem in this circuitry will directly impact the output power flatness and accuracy, which is specified.

Since the ALC is not frequency dependent, the test is performed at two frequency points; one point in Band 0 and the other in Band 1. Checking the ALC in these two bands verifies its operation in the synthesizer's low frequency RF path and high frequency RF path. At each frequency, the ALC is tested over its entire power range, −20 dBm up to maximum available leveled power.

11.1 Test Equipment

Power Meter	HP 436A Option 022
Power Sensor	HP 8485A
Adapters:	
APC 3.5 (f) to APC 3.5 (f)[1]	HP P/N 5061-5311
APC 3.5 (f) to Type N (m)[2]	HP P/N 1250-1744
Cable, Semi-rigid coax, SMA (m) to SMA (m)	HP P/N 08340-20124

11.2 Procedure

1. The softkeys provided for this test are as follows:

   VERIFY – Runs the ALC verification. This is key you should select to meet the requirements of an operation verification.

   SETUP – Provides a graphical display of the ALC accuracy test setup on the CRT.

   JANITOR – Return to the test menu.

   Select the desired softkey and respond to any prompts provided by the program.

2. Upon completion of the verification, the test will indicate pass or fail and will display the following softkeys:

   PRINT – Output the test results to the printer.
   DISPLAY – Output the test results to the CRT.
   DONE – Return to the menu in step 1.

   Select the desired softkey and respond to any prompts provided by the program.

---

1. Required for an HP 8340A/B DUT only.
2. Required for an HP 8341A/B DUT only.

Chapter 12. Output Power Accuracy Test

12.0 Description

The Output Power Accuracy Test checks the flatness and accuracy of the synthesizer's RF output. The test is performed across the synthesizer's entire frequency range with three different power level settings. For this test, a power sensor and power meter are connected to the synthesizer's RF output. The data obtained from this test is required by the Maximum Leveled Output Power test and the Attenuator Calibration test.

NOTE

This test will not run unless the power sensor has been characterized per the instructions in Chapter 6. The data file generated for the power sensor must be on the data disc currently in the disc drive.

12.1 Test Equipment

Power Meter ..... HP 436A Option 022
Power Sensor ..... HP 8485A
Adapters:
APC 3.5 (f) to APC 3.5 (f)[1] ..... HP P/N 5061-5311
APC 3.5 (f) to Type N (m) ..... HP P/N 1250-1744

12.2 Procedure

1. The softkeys provided for this test are as follows:

SET UP – Provides a graphical display of the Output Power Accuracy test setup on the CRT.

VERIFY – Runs the test which verifies the output power accuracy performance of the synthesizer. This is the key you should select to meet the requirements for the operation verification.

SELECT – Allows you to check the output power accuracy for a specific frequency range. Also allows you to select the number of points and power level you wish to test. When the program requests the test parameters, only enter the number. For example, when the program requests the start frequency, enter 4 (not 4 GHz). No data is stored when this softkey is selected.

JANITOR – Returns you to the test menu.

Select the desired softkey and respond to the prompts provided by the program.

1. Required for an HP 8340A/B DUT only.

2. When the test you selected is finished, the program will indicate whether the instrument passed or failed the test. In either case, a menu will be displayed with the following selections:

DISPLAY	– Outputs the test results to the CRT.
PRINT	– Output the test results to the Printer.
BEGIN	– Returns you to the Output Power Accuracy Test menu.
JANITOR	– Returns you to the test menu.

If the test fails, the program will suggest that the instrument be adjusted and tested again. Select the desired softkey and respond to the prompts provided by the program.

Chapter 13. Maximum Leveled Output Power Test

13.0 Description

The Maximum Leveled Output Power test verifies that the synthesizer meets its maximum leveled power specifications over a variety of sweep ranges, sweep modes, and sweep speeds. The test uses the internal power meter and unleveled indication circuitry within the synthesizer to measure maximum leveled power. Upon completion of the test, the program uses the measurement data obtained from this test and the test data obtained from the Output Power Accuracy test to calculate the actual maximum leveled output power. The results from the calculations are compared with the maximum leveled output power specifications to determine if the DUT passed or failed.

Since the test uses circuitry internal to the synthesizer to perform the measurements, no equipment is required except for a 20 dB attenuator. The 20 dB attenuator is used to provide a 50 Ohm load on the output of the DUT (improves the measurement accuracy).

NOTE

This test will not run unless the Output Power Accuracy test has been performed. The data file generated for the verification must be on the data disc currently in the disc drive.

13.1 Test Equipment

20 dB Attenuator ..... HP 8493C Option 020
Adapters:
APC 3.5 (f) to APC 3.5 (f)[1] ..... HP P/N 5061-5311
APC 3.5 (f) to Type N (m)[2] ..... HP P/N 1250-1744

13.2 Procedure

1. The softkeys provided for this test are as follows:

FULL – Runs the entire Maximum Leveled Output Power test. This is the key you should select to meet the requirements for the operation verification.

SELECT – Allows you to select the sweep mode and sweep range you wish to test. When the program prompts you for the test condition, type the appropriate test number and press enter.

1. Required for an HP 8340A/B DUT only.
2. Required for an HP 8341A/B DUT only.

CORRECT – Allows you to view the power accuracy correction factors, obtained from the Output Power Accuracy test, which will be used during the calculation of the maximum leveled output power. Examine the data and then press continue on the computer's keyboard.

JANITOR – Returns you to the test menu.

Select the desired softkey and respond to the prompts provided by the program.

2. When the test you selected is finished, the program will indicate whether the instrument passed or failed the test. In either case, a menu will be displayed with the following selections:

RETEST – Returns you to the MAXIMUM LEVELED OUTPUT POWER menu.
JANITOR – Returns you to the test menu.
DISPLAY – Outputs the test results to the CRT.
PRINT – Output the test results to the Printer.

Select the desired softkey and respond to the prompts provided by the program.

Chapter 14. RF Attenuator Calibration

14.0 Description

This program performs three functions:

- It adjusts the instrument's attenuator calibration constants to compensate for errors in the 90 dB step attenuator (for those instruments so equipped).
- It verifies power accuracy at each attenuator step.
- It sums the attenuator performance data with output power accuracy data and compares the results with the instrument's performance specifications.

NOTE

This test will not run unless the IF attenuator has been characterized per instructions in Chapter 6 and the Output Power Accuracy test has been run. The data files generated by the IF attenuator and Output Power Accuracy programs must be on the data disc currently in the disc drive.

14.1 Test Equipment

Local Oscillator	HP 8340A Option HO1 or HP 8340A/B Option 001
Spectrum Analyzer	HP 3585A
Mixer	HP P/N 0955-0307
20 dB Attenuator	HP 8493C Option 020
10 dB Attenuator	HP 8493C Option 010
Step Attenuator (Calibrated at 1 MHz)	HP 355D
Low Pass Filter	HP P/N 9135-0260
Amplifier	HP 8447F
Cables:	
Semi-rigid coax, SMA (m) to SMA (m)	HP P/N 08340-20124
BNC (m) to BNC (m), (7 required)	HP P/N 8120-1840
Adapters:	
APC 3.5 (f) — APC 3.5 (f)[1]	HP P/N 5061-5311
APC 3.5 (f) to Type N (m)[2]	HP P/N 1250-1744
SMA (m) to BNC (f)	HP P/N 1250-1200

1. Required for an HP 8340A/B DUT only.
2. Required for an HP 8341A/B DUT only.

14.2 Procedure

NOTE

Instrument Calibration Constants tell the program whether or not an attenuator is installed. If an attenuator was installed after time of manufacture, Calibration Constant #59 should have been changed to reflect the addition. If this Cal Constant was not updated, the program will tell you that no attenuator exists, even though one is actually installed. To update the Cal Constants to reflect the correct option configuration (i.e., 90 dB attenuator option installed), return to the test menu and select the Utility softkey. Refer to Chapter 16, and then select the Chg Option softkey.

PROBLEM SOLVER

If you run into difficulties during this test (due to an incorrect test setup, etc), and the softkey menu gives you no ABORT selection, press [Carry On] or other "continue" commands until you get to a menu that lets you abort the test. It is not recommended to do a full program break. If you break the program, some Cal Constants may already have been altered in the instrument. A controlled abort allows the program to replace the instrument's original Cal Constants before exiting the test. A hard STOP does not do this, and when you go to run the program again the program will indicate:

DUT CAL #AT10 OFFSET = ### BUT FILE = ###

[DUT OK] [NEITHER] [FILE OK]

This screen is telling you that a Cal Constant difference exists between the data disc image file and the instrument. It will then let you choose which is the correct Cal Constant. In this case, the image file is correct. For each Cal Constant discrepancy (sequentially) displayed, press [FILE OK]. After several Cal Constant discrepancies are displayed, the program will return to normal operation.

1. The softkeys provided for this test are as follows:

ADJUST – Does everything. It adjusts the Calibration Constants; verifies power accuracy at every attenuator step; it also sums the attenuator performance data with the output power accuracy data and compares the results to instrument specifications. After this key is selected, press the **ALL** softkey to adjust and measure all of the attenuator steps. If only one step is selected, no data will be stored.

MEASURE – This is a subset of the ADJUST test. MEASURE verifies the low output power accuracy at every attenuator step; it also sums the attenuator performance data with the output power accuracy data and compares the results to instrument specifications. After this key is selected, press the **ALL** softkey to measure all the attenuator steps and store the data. If only one step is selected, no data will be stored.

SPEC – This is a subset of the above tests. SPEC simply takes existing attenuator performance data and sums it with output power accuracy data. The result is compared to instrument specifications

Viewdat – Allows you to view the test result data on the computer's CRT. After this key is pressed, you are given a choice of viewing the individual attenuator step data or viewing all the data.

Hardcpy – Same as the **Viewdata** softkey except the selected data is output to the printer.

JANITOR – Returns you to the test menu.

Select the desired softkey and respond to the prompts provided by the program.

NOTE

The test setup for the Adjust and Measure portions of the RF Attenuator Calibration is extremely critical. The tests and adjustments are performed at low RF output power levels (down to −90 dBm). Use of a defective cable or adapter, or having a loose cable connection in the test setup may cause a misadjustment of the instrument or failure in the low output power accuracy test. If the test results indicate that the instrument failed low output power accuracy, check the test setup and re-run the selected test (either Adjust or Measure).

NOTE

The program will repeat the "Set IF attenuator" statement for each measurement, even though the proper attenuation has already been set.

Chapter 15. Frequency Switching Time Test

15.0 Description

The Frequency Switching Time test verifies that the synthesizer meets its frequency switching time specification. The test uses the synthesizer's negative blanking output on its rear panel and an HP 5316A to measure the time it takes the instrument to switch from one CW frequency to another. The frequencies selected for testing are those which will cause the worst case delay in the switching time.

15.1 Test Equipment

Universal Counter ..... HP 5316A
Cable:
BNC (m) to BNC (m) ..... HP P/N 8120-1840

15.2 Procedure

1. Connect the equipment and set the HP 5316A as shown on the CRT. Press **Cont.**
2. The softkeys provided for this test are as follows:

FullTst – Performs the entire Frequency Switching Time test and compares the test results to the synthesizer's specifications. Upon completion of this test, the test results will be displayed. Press the **Carry On** softkey and then select either **RE-TEST**, returns you to the FREQUENCY SWITCHING TIME menu, or **JANITOR**, returns you to the test menu.

Other – Allows you to select the two CW frequencies between which the test will switch. After selecting **Other,** you are given a choice of entering the two frequency points (**A to B**), entering one frequency point and the frequency step size (**A to A+d**), running the full test (**FullTest**), or returning to the test menu (**Janitor**). If you select **A to B** or **A to A+d**, the frequency you enter must be in MHz.

Janitor – Returns you to the test menu.

Select the desired softkey and respond to the prompts provided by the program.

Chapter 16. Test Menu Utility Softkey

16.0 Description

The test menu **Utility** softkey provides you with the capability of changing the synthesizer's defined option configuration (option configuration defined by the Cal Constants) from your computer, displaying data from previously run tests, or displaying the test status of previously tested instruments. The feature which allows you to change the synthesizer's defined option configuration should be used after an option has been added to or deleted from the synthesizer.

16.1 Test Equipment

None Required.

16.2 Procedure

1. After the **Utility** softkey provided in the test menu has been selected, the program will display the following softkey choices:

Chg Option – Allows you to change the synthesizer's defined option configuration. After selecting this softkey, input each of the synthesizer's 3 digit option strings (one at a time) and press ENTER after each entry. Press ENTER when finished inputting the options and then check the option list. Upon completion of the option entry, the program will automatically update the calibration constants in the synthesizer and the data file on the data disc to reflect the option configuration you entered.

Dsp Data – Allows you to display or print the test data from previously run tests. The data displayed will be for the instrument whose serial number is currently in the computer's memory and for the type of testing you selected while in the TEST SELECTION menu (i.e., either the Operation Verification or the Attenuator Calibration). After selecting this softkey, the program will display the test menu and allow you to output all the test data (**ALL DATA** softkey), output the data for one test (**SELECT** softkey), or return to the UTILITIES menu (**EXIT** softkey). The **SELECT** softkey outputs the data for the test at which the cursor points. Use the keyboards UP or DOWN arrow keys or the rotary control knob on the keyboard to position the cursor.

Prt Status – Allows you to display or print the test status for the synthesizer whose serial number is currently in the computer's memory. The status displayed will be for the type of testing you selected while in the TEST SELECTION menu (i.e., either the Operation Verification or the Attenuator Calibration menu).

Exit – Returns you to the test menu.

Select the desired softkey and respond to the prompts provided by the program.

2. If you have finished viewing the test data (or the test status) obtained from the Operation Verification and wish to view the data from the Attenuator Calibration (or vice versa), you must return to the TEST SELECTION menu. Press the exit softkeys until you reach this menu and then press the appropriate softkey.

NOTE

To view a DUT's test data or test status, it is not necessary to have the DUT connected to the HP-IB. The only requirements are that the DUT's data disc be installed in the data disc drive, you know the DUT's serial number, and a DUT with a different serial number is not attached to the HP-IB. To implement this feature, access the TEST SELECTION menu and select the type of testing for which you wish to view the data. If a DUT is not attached to the HP-IB, the program will ask you if you wish to continue without one. Press the YES softkey and enter the DUT's serial number. Proceed to the test menu and select the Utility softkey. From here, you can either display the test data or test status as described above.

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February, 1986

HP Part No. 08340-90307

Printed in U.S.A.

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Software Support Request

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COMPANY NAME	SYSTEM MODEL	SERIAL #

DEPARTMENT/DIVISION/BUILDING	SOFTWARE PRODUCT INFORMATION	NAME
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		REVISION CODE

CONFIGURATION (Include the minimum hardware, software and firmware on which the problem occurs. This should include applicable options, date code and revision, etc.)

PROBLEM DESCRIPTION (Include environment, symptom, what you were trying to do, what went wrong, and any other information that might be helfpul.)

DOCUMENTATION (List all the supportive documentation included with this report. You must provide all relevant programs, data lines, data bases, etc. Please label the media.)

MEDIA	DESCRIPTION
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HEWLETT PACKARD **INSTRUMENT SYSTEM**

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To be completed by the local HP Systems Engineer

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Severity Level:
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product name

Classification:
☐ Enhancement Request ☐ New Problem

product number | revision | uu ff

Category:
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Section V. Adjustments

INTRODUCTION

This section provides adjustment procedures for the HP 8340B/41B Synthesized Sweepers. These procedures should not be performed as routine maintenance but should be used (1) after replacement of a part or component, or (2) when performance tests show that the instrument's specifications cannot be met. Before attempting any adjustment, allow 1 hour warm-up time for the instrument. Table 5-1 lists the adjustment procedures by test number in the order they appear in this Section. Table 5-2 lists all factory selected components. Table 5-3 lists adjustment procedures that interact between assemblies. This table lists the adjustment paragraphs that must be checked when an assembly is adjusted, parts replaced, or the assembly replaced.

SAFETY CONSIDERATIONS

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

WARNING

Adjustments in this section are performed with power supplied to the instrument while protective covers are removed. There are voltages at many points in the instrument which can, if contacted, cause personal injury or death. Be extremely careful. Adustments should be performed only by trained service personnel.

Power is still applied to this instrument with the LINE switch set to STANDBY. There is no OFF position on the LINE switch. Before removing or installing any assembly or printed circuit board, remove the power cord from the rear of the instrument.

Capacitors inside the instrument may still be charged, even if the instrument has been disconnected from its source of ac power. Use a non-metallic adjustment tool whenever possible.

EQUIPMENT REQUIRED

Table 4-1 lists the equipment required for the adjustment procedures. If the test equipment recommended is not available, other equipment may be used if its performance meets the "Critical Specifications" listed in the table. The test setup used for an adjustment procedure is referenced in each procedure.

ADJUSTMENT TOOLS

For adjustments requiring a non-metallic tuning tool, use fiber tuning tool, HP Part Number 8710-0033. In situations not requiring non-metallic tuning tools, an ordinary small screwdriver or other suitable tool is sufficient. However, use of a non-metallic adjustment tool whenever possible is recommended. Never try to force any adjustment control in the instrument. This is especially critical when tuning variable slug-tuned inductors and variable capacitors.

FACTORY SELECTED COMPONENTS

Factory selected components are identified with an asterisk on the schematic diagram. The range of their values and functions are listed in Table 5-2. Part Numbers for selected values are located in Table 5-4.

RELATED ADJUSTMENTS

Any adjustments which interact with, or are related to, other adjustments are indicated in the adjustment procedures. It is important that adjustments so noted are performed in the order indicated to ensure the instrument meets its specifications.

LOCATION OF TEST POINTS AND ADJUSTMENTS

Illustrations showing the locations of assemblies containing adjustments and locations of those adjustments within the assemblies are contained within the adjustment procedures where they apply. Also, major assembly and component location illustrations are located in volume 3.

ACCESSING AND STORING CALIBRATION CONSTANTS

Introduction

The HP 8340B/41B contains three memory areas reserved for calibration constants. These areas are (1) working, (2) protected, and (3) default. A detailed description of these memory areas is contained in the introduction of Section 8 under the heading "Calibration Constants." When performing adjustments, some calibration constants in the "working memory area" are changed or "adjusted" to optimize performance parameters. Once these calibration constants are set for best instrument performance, the new values should be copied from the "working memory area" to the "protected memory area." The printed copy of the calibration constants (located underneath the top cover of the instrument should also be updated to reflect the new values. Once updated, it should then be returned to its storage location. This calibration data then may be used later in case of loss of valid calibration constants data in the "working memory area."

Procedure to Access Calibration Constants

In the adjustment procedures, calibration constants stored in working memory will be changed (adjusted). A calibration constant can be accessed by pushing the following key sequence:

[SHIFT] [GHz] [number of the Cal. Constant, 1 to 99] [Hz]
[SHIFT] [MHz] [1] [2] [Hz]
[SHIFT] [kHz] [2] [2] [Hz]

The ENTRY DISPLAY will indicate the calibration constant number on the left and the present value on the right. Use the STEP keys to select a different calibration constant number. The ENTRY keyboard or the front panel rotary knob can be used to change the value. After the new value has been entered, press the **[Hz]** key to retain the new values in "working memory area."

Procedure to Store the Calibration Constants

After adjustments of the calibration constants are completed, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence:

[SHIFT] [MHz] [1] [4] [Hz]
[SHIFT] [kHz] [5] [3] [4] [9] [Hz] Wait for "CALIBRATION RESTORED" to be displayed in the ENTRY DISPLAY and then press **[INSTR PRESET]**.

Table 5-1. Adjustment Procedures in Paragraph Order

Test	Title	Page
5-1	+22 Vdc Power Supply, A35	5-13
5-2	10 MHz Standard, A51	5-15
5-3	100 MHz Voltage-Controlled Crystal Oscillator (VCXO), A30	5-19
5-4	M/N Loop, A23, A33, and A32A1	5-23
5-5	20/30 Loop Phase Lock, A36, A38, A39, A40, and A43	5-27
5-6	YO Pretune DAC, A54	5-37
5-7	YO Main Driver, A55	5-39
5-8	YO Loop Adjustments	5-43
5-9	FM Accuracy and FM Overmod Adjustment	5-53
5-10	YO Delay Compensation, A54	5-57
5-11	3.7 GHz Oscillator, A8	5-63
5-12	Marker/Bandcross, A57	5-65
5-13	Sweep Generator, A58	5-67
5-14	Unleveled RF Output Adjustments	5-71
5-15	ALC Adjustments	5-89
5-16	Leveled RF Output Adjustments	5-101
5-17	RF Output Power Flatness and Adjustment	5-115
5-18	Pulse Adjustments	5-121
5-19	External Module Leveling Adjustment	5-129

Table 5-2. Factory Selected Components

Reference Designator	Range of Values	Adjustment Paragraph Number	Function of Component
A25C11	Either 0 or 1000 PF	5-14	Selected for optimum Log-Amp speed and stability
A25R36	4640 - 9090 Ohms	5-14	Adjusts temperature compensation of Band 1-4 detector[1].
A25R37	3830 - 6190 Ohms	5-14	
A25R109	1620 - 3830 Ohms	5-14	Adjusts temperature compensation of Band 0 detector.
A25R115	4640 - 9090 Ohms	5-14	
A30C8	5.6 - 11 PF	5-3	Sets range of C4 so midposition is 100 MHz.
A30L4	0.22 - 0.68 mH	5-3	Centers Oscillator at 100 MHz.
A30R67	110 - 825 Ohms	5-3	Part of attenuator to set 400 MHz output at −10 dBm.
A30R68	6.8 - 61.9 Ohms	5-3	Part of attenuator to set 400 MHz output at −10 dBm.
A30R69	110 - 825 Ohms	5-3	Part of attenuator to set 400 MHz output at −10 dBm.
A39C49	8.2 - 16 PF	5-5	Sets range of C50 so midposition is 160 MHz.
A48C22	100 - 160 PF	5-8	Selected to tune RLC network at input of Buffer Amplifier to 25 MHz passband.
A48R22	6.2 - 23.7 Ohms	5-8	Selected to adjust resistance of RLC network at input of Buffer Amplifier for passband bandwidth of 18 to 32 MHz.

[1] The highest Band available with an HP 8341B is Band 3.

Table 5-3. Adjustment Interdependence Between Assemblies (1 of 3)[2]

Assembly Adjusted or Replaced	Associated Adjustments That Must Be Made	Procedure Paragraphs
A1 Alpha Display	None	
A2 Display Driver	None	
A3 Display Processor	None	
A4 Not Assigned		
A5 Keyboard	None	
A6 Keyboard Interface	None	
A7 Lower Keyboard	None	
A8 3.7 GHz Oscillator	Band 0 ALC Loop Gain	5-11; 5-15, steps 15, 18 through 20.
A9 Band 0 Pulse Modulator	None	
A10 Directional Coupler	Flatness Adjustment	5-16, steps 1 through 17.
A11 Bands 1-4[1] Detector	A25R36 and A25R37; High Bands and Band 0 ALC Adjustment; Flatness; ADC Adjustment; Pulse	5-15, steps 1 through 9, 15 through 20; 5-17, 5-18.
A12 Band 0 Splitter/ Detector	Band 0 ALC, ADC, Flatness, A25R109, and A25R115.	5-15, steps 1 through 4, 10 through 20; 5-17, steps 12 through 23.
A13 SYTM	SYTM Tracking and SRD Bias Adjustment	5-14 and 5-16
A14 Band 1-4[1] Power Amp.	SRD Bias and ALC Loop Gain.	5-14 and 5-16, A24 and A26 adjustments only.
A15 Band 0 Low-Pass Filter	None	
A16 Band 1-4[1] Modulator/Splitter	SRD Bias and ALC Loop Gain.	5-14 and 5-16, A24 and A26 adjustments only.
A17 Band 0 Mixer	None	
A18 Band 0 Power Ampl.	None	
A19 Capacitor Assembly	None	
A20 RF Section Filter	None	
A21 Pulse Modulator Driver	Pulse Adjustment	5-18

1. The highest Band available with an HP 8341B is Band 3.
2. Assemblies which are not listed do not require adjustment.

Table 5-3. Adjustment Interdependence Between Assemblies (2 of 3)

Assembly Adjusted or Replaced	Associated Adjustments That Must Be Made	Procedure Paragraphs
A22 Not Assigned		
A23 FM Driver	FM Gain Adjustment	5-19, steps 1 through 5
A24 Attenuator Driver/SRD Bias	SRD Bias Adjustment	5-14 and 5-16, A24 adjustments only.
A25 ALC Detector	ALC, ADC, Pulse, and External Leveling Adjustment	5-15; 5-17, steps 18 through 23; 5-18.
A26 Linear Modulator	Loop Gain, SRD Bias, Integrator Gate Balance.	5-16; 5-18
A27 Level Control	Flatness, ALC, and ADC Adjustment	5-15 and 5-17.
A28 SYTM Driver	SYTM Tracking and SRD Bias Adjustment	5-14 and 5-16
A29 Reference Phase Detector	None	
A30 100 MHz VCXO	A30C1 thru C4	5-3
A31 M/N Phase Detector	None	
A32 M/N VCO	A32A2C1, A32A2C5	5-4
A33 M/N Output	None	
A34 Reference - M/N Mother Board	None	
A35 Rectifier	+22V Supply	5-1.
A36 PLL1 VCO	A36L7, A36L8	5-5, steps 44 thru 61.
A37 PLL1 Divider	None	
A38 PLL1 IF	A38L11 thru A38L13.	5-5, steps 62 through 76
A39 PLL3 Upconverter	A39C50, A39L4, L16, L17	5-5 steps 32 through 43
A40 PLL2 VCO	PLL2 Adjustments	5-5, steps 1 through 31
A41 PLL2 Phase Detector	None	
A42 PLL2 Divider	None	
A43 PLL2 Discriminator	PLL2 Adjustments	5-5, steps 1 through 31.

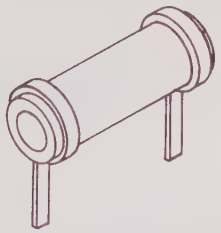
Table 5-3. Adjustment Interdependence Between Assemblies (3 of 3)

Assembly Adjusted or Replaced	Associated Adjustments That Must Be Made	Procedure Paragraphs
A44 YIG Oscillator	YO Adjustment, Delay Adjustment, and YTM Delay.	5-7; 5-8; 5-9; 5-10; 5-14, steps 32 through 69.
A45 Directional Coupler	Flatness Adjustment	5-17
A46 7 GHz Low-Pass Filter	None	
A47 Sense Resistor Assembly	YO Adjustment and Delay, and YTM Adjustment and Delay.	5-7, 5-10, 5-14, and 5-16.
A48 YO Loop Sampler	Sampler Adjustment	5-8
A49 YO Loop Phase Detector	YO Loop and FM Adjustments	5-8, 5-9
A50 YO Loop Interconnect	None	
A51 Reference Oscillator	10 MHz Standard Adjustment	5-2
A52 Positive Regulator	None	
A53 Negative Regulator	None	
A54 YO Pretune DAC/Delay Compensation	YO Pretune, YO Main Driver, and YO Delay Compensation, SYTM Delay Compensation	5-6, 5-7, 5-10, 5-14 and 5-16.
A55 YO Driver	YO Adjustment	5-7.
A56 - 15V Regulator	None	
A57 Marker/ Bandcross	Marker Bandcrossing Adjustment	5-12
A58 Sweep Generator	Sweep Generator Adjustment	5-13.
A59 Digital Interface	None	
A60 Processor	None	
A61 Not Assigned		
A62 Main Mother Board	None	
A63 90 dB RF Attenuator	Flatness and RF Attenuator Calibration	5-17, steps 1 through 17. For RF Attenuator Calibration, see manual supplement titled "Automated Test Procedures."

Table 5-4. HP Part Numbers of Standard Value Components (1 of 4)

CAPACITORS

RANGE: 1 to 24 pF
TYPE: Tubular
TOLERANCE:
1 to 9.1 pF = ±.25 pF
10 to 24 pF = ±5%



RANGE: 27 to 680 pF
TYPE: Dipped Mica
TOLERANCE: ±5%

Value (pF)	HP Part Number	CD	Value (pF)	HP Part Number	CD
1.0	0160-2236	8	33	0160-2150	5
1.2	0160-2237	9	36	0160-2308	5
1.5	0150-0091	8	39	0140-0190	7
1.8	0160-2239	1	43	0160-2200	6
2.0	0160-2240	4	47	0160-2307	4
2.2	0160-2241	5	51	0160-2201	7
2.4	0160-2242	6	56	0140-0191	8
2.7	0160-2243	7	62	0140-0205	5
3.0	0160-2244	8	68	0140-0192	9
3.3	0150-0059	8	75	0160-2202	8
3.6	0160-2246	0	82	0140-0193	0
3.9	0160-2247	1	91	0160-2203	9
4.3	0160-2248	2	100	0160-2204	0
4.7	0160-2249	3	110	0140-0194	1
5.1	0160-2250	6	120	0160-2205	1
5.6	0160-2251	7	130	0140-0195	2
6.2	0160-2252	8	150	0140-0196	3
6.8	0160-2253	9	160	0160-2206	2
7.5	0160-2254	0	180	0140-0197	4
8.2	0160-2255	1	200	0140-0198	5
9.1	0160-2256	2	220	0160-0134	1
10.0	0160-2257	3	240	0140-0199	6
11.0	0160-2258	4	270	0140-0210	2
12.0	0160-2259	5	300	0160-2207	3
13.0	0160-2260	8	330	0160-2208	4
15.0	0160-2261	9	360	0160-2209	5
16.0	0160-2262	0	390	0140-0200	0
18.0	0160-2263	1	430	0160-0939	4
20.0	0160-2264	2	470	0160-3533	0
22.0	0160-2265	3	510	0160-3534	1
24.0	0160-2266	4	560	0160-3535	2
27	0160-2306	8	620	0160-3536	3
30	0160-2199	2	680	0160-3537	4

Table 5-4. HP Part Numbers of Standard Value Components (2 of 4)

RESISTORS

RANGE: 10 to 464K Ohms
TYPE: Fixed Film
WATTAGE: .125 at 125°C
TOLERANCE: ±1.0%

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD
10.0	0757-0346	2	464	0698-0082	7	21.5K	0757-0199	3
11.0	0757-0378	0	511	0757-0416	7	23.7K	0698-3158	4
12.1	0757-0379	1	562	0757-0417	8	26.1K	0698-3159	5
13.3	0698-3427	0	619	0757-0418	9	28.7K	0698-3449	6
14.7	0698-3428	1	681	0757-0419	0	31.6K	0698-3160	8
16.2	0757-0382	6	750	0757-0420	3	34.8K	0757-0123	3
17.8	0757-0294	9	825	0757-0421	4	38.3K	0698-3161	9
19.6	0698-3429	2	909	0757-0422	5	42.2K	0698-3450	9
21.5	0698-3430	5	1.0K	0757-0280	3	46.4K	0698-3162	0
23.7	0698-3431	6	1.1K	0757-0424	7	51.1K	0757-0458	7
26.1	0698-3432	7	1.2K	0757-0274	5	56.2K	0757-0459	8
28.7	0698-3433	8	1.33K	0757-0317	7	61.9K	0757-0460	1
31.6	0757-0180	2	1.47K	0757-1094	9	68.1K	0757-0461	2
34.8	0698-3434	9	1.62K	0757-0428	1	75.0K	0757-0462	3
38.3	0698-3435	0	1.78K	0757-0278	9	82.5K	0757-0463	4
42.2	0757-0316	6	1.96K	0698-0083	8	90.9K	0757-0464	5
46.4	0698-4037	0	2.15K	0698-0084	9	100K	0757-0465	6
51.1	0757-0394	0	2.37K	0698-3150	6	110K	0757-0466	7
56.2	0757-0395	1	2.61K	0698-0085	0	121K	0757-0467	8
61.9	0757-0276	7	2.87K	0698-3151	7	133K	0698-3451	0
68.1	0757-0397	3	3.16K	0757-0279	0	147K	0698-3452	1
75.0	0757-0398	4	3.48K	0698-3152	8	162K	0757-0470	3
82.5	0757-0399	5	3.83K	0698-3153	9	178K	0698-3243	8
90.0	0757-0400	9	4.22K	0698-3154	0	196K	0698-3453	2
100	0757-0401	0	4.64K	0698-3155	1	215K	0698-3454	3
110	0757-0402	1	5.11K	0757-0438	3	237K	0698-3266	5
121	0757-0403	2	5.62K	0757-0200	7	261K	0698-3455	4
133	0698-3437	2	6.19K	0757-0290	5	287K	0698-3456	5
147	0698-3438	3	6.81K	0757-0439	4	316K	0698-3457	6
162	0757-0405	4	7.50K	0757-0440	7	348K	0698-3458	7
178	0698-3439	4	8.24K	0757-0441	8	383K	0698-3459	8
196	0698-3440	7	9.09K	0757-0288	1	422K	0698-3460	1
215	0698-3441	8	10.0K	0757-0442	9	464K	0698-3260	9
237	0698-3442	9	11.0K	0757-0443	0			
261	0698-3132	4	12.1K	0757-0444	1			
287	0698-3443	0	13.3K	0757-0289	2			
316	0698-3444	1	14.7K	0698-3156	2			
348	0698-3445	2	16.2K	0757-0447	4			
383	0698-3446	3	17.8K	0698-3136	8			
422	0698-3447	4	19.6K	0698-3157	3			

Table 5-4. HP Part Numbers of Standard Value Components (3 of 4)

RESISTORS

RANGE: 10 to 1.47M Ohms
TYPE: Fixed Film
WATTAGE: .5 at 125°C
TOLERANCE: ±1.0%

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD
10.0	0757-0984	4	215	0698-3401	0	4.64K	0698-3348	4	110K	0757-0859	2
11.0	0757-0985	5	237	0698-3102	8	5.11K	0757-0833	2	121K	0757-0860	5
12.1	0757-0986	6	261	0757-1090	5	5.62K	0757-0834	3	133K	0757-0310	0
13.3	0757-0001	6	287	0757-1092	7	6.19K	0757-0196	0	147K	0698-3175	5
14.7	0698-3388	2	316	0698-3402	1	6.81K	0757-0835	4	162K	0757-0130	2
16.2	0757-0989	9	348	0698-3403	2	7.50K	0757-0836	5	178K	0757-0129	9
17.8	0698-3389	3	383	0698-3404	3	8.25K	0757-0837	6	196K	0757-0063	0
19.6	0698-3390	6	422	0698-3405	4	9.09K	0757-0838	7	215K	0757-0127	7
21.5	0698-3391	7	464	0698-0090	7	10.0K	0757-0839	8	237K	0698-3424	7
23.7	0698-3392	8	511	0757-0814	9	12.1K	0757-0841	2	261K	0757-0064	1
26.1	0757-0003	8	562	0757-0815	0	13.3K	0698-3413	4	287K	0757-0154	0
28.7	0698-3393	9	619	0757-0158	4	14.7K	0698-3414	5	316K	0698-3425	8
31.6	0698-3394	0	681	0757-0816	1	16.2K	0757-0844	5	348K	0757-0195	9
34.8	0698-3395	1	750	0757-0817	2	17.8K	0698-0025	8	383K	0757-0133	5
38.3	0698-3396	2	825	0757-0818	3	19.6K	0698-3415	6	422K	0757-0134	6
42.2	0698-3397	3	909	0757-0819	4	21.5K	0698-3416	7	464K	0698-3426	9
46.4	0698-3398	4	1.00K	0757-0159	5	23.7K	0698-3417	8	511K	0757-0135	7
51.1	0757-1000	7	1.10K	0757-0820	7	26.1K	0698-3418	9	562K	0757-0868	3
56.2	0757-1001	8	1.21K	0757-0821	8	28.7K	0698-3103	9	619K	0757-0136	8
61.9	0757-1002	9	1.33K	0698-3406	5	31.6K	0698-3419	0	681K	0757-0869	4
68.1	0757-0794	4	1.47K	0757-1078	9	34.8K	0698-3420	3	750K	0757-0137	9
75.0	0757-0795	5	1.62K	0757-0873	0	38.3K	0698-3421	4	825K	0757-0870	7
82.5	0757-0796	6	1.78K	0698-0089	4	42.2K	0698-3422	5	909K	0757-0138	0
90.0	0757-0797	7	1.96K	0698-3407	6	46.4K	0698-3423	6	1M	0757-0059	4
100	0757-0198	2	2.15K	0698-3408	7	51.1K	0757-0853	6	1.1M	0757-0139	1
110	0757-0798	8	2.37K	0698-3409	8	56.2K	0757-0854	7	1.21M	0757-0871	8
121	0757-0799	9	2.61K	0698-0024	7	61.9K	0757-0309	7	1.33M	0757-0194	8
133	0698-3399	5	2.87K	0698-3101	7	68.1K	0757-0855	8	1.47M	0698-3464	5
147	0698-3400	9	3.16K	0698-3410	1	75.0K	0757-0856	9			
162	0757-0802	5	3.48K	0698-3411	2	82.5K	0757-0857	0			
178	0698-3334	8	3.83K	0698-3412	3	90.9K	0757-0858	1			
196	0757-1060	9	4.22K	0698-3346	2	100K	0757-0367	7			

Table 5-4. HP Part Numbers of Standard Value Components (4 of 4)

FIXED COIL					
Tolerance: 10% Unshielded					
Value	**HP Part Number**	**CD**	**Value**	**HP Part Number**	**CD**
1 MH	9140-0137	1	390 NH	9100-2254	3
5 MH	9140-0072	3	470 NH	9100-2255	4
10 MH	9140-0131	5	560 NH	9100-2232	7
24 MH	9100-2867	4	680 NH	9140-0141	7
50 NH	9100-2891	4	820 NH	9100-2257	6
51 NH	9135-0073	3	1.2 UH	9100-2258	7
68 NH	9135-0081	3	1.8 UH	9100-2260	1
100 NH	9100-2247	4	2.2 UH	9140-0098	3
120 NH	9100-2248	5	3.3 UH	9140-0111	1
			4.7 UH	9140-0144	0
150 NH	9100-2249	6			
180 NH	9100-2250	9	5.6 UH	9100-1618	1
220 NH	9100-2251	0			
270 NH	9100-2252	1			
330 NH	9100-0368	6			

5-1. +22 VDC POWER SUPPLY, A35

Reference

Performance Test: None
Service Section: Power Supplies

Description

The +22V supply is adjusted for +22 Vdc.

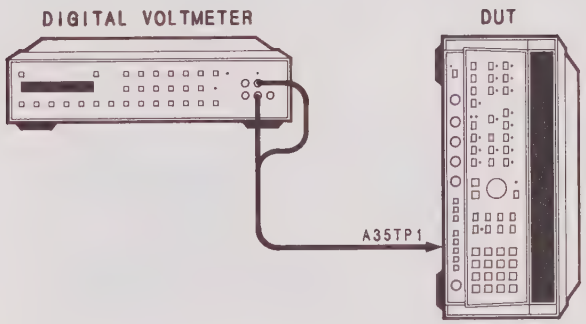


Figure 5-1. +22 Volt Power Supply Adjustments Setup

Equipment

Digital Voltmeter DUM ..... HP 3456A

Procedure

1. Position DUT in the test position and connect equipment as shown in Figure 5-1.
2. Set LINE switch to ON.
3. The yellow +22V indicator on A35 should be lit.
4. The DVM indication should be +22.000 ±0.010 Vdc. If the indication is out of tolerance, adjust A35R3 +22 ADJ (Figure 5-2) control for the specified voltage.

5-1. +22 VDC POWER SUPPLY, A35 (Cont'd)

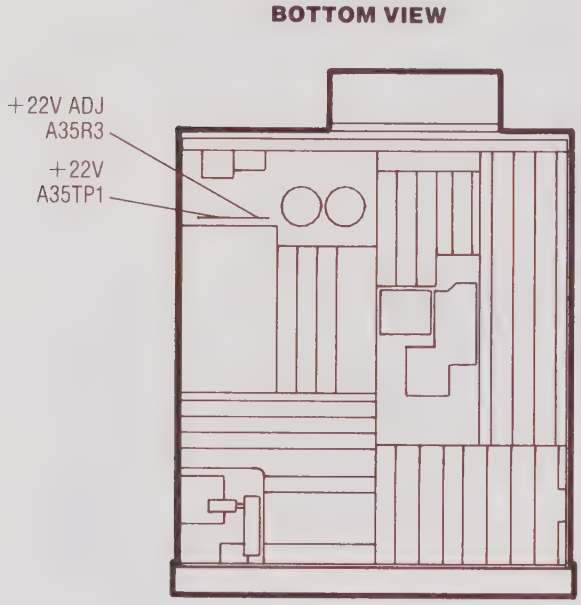


Figure 5-2. +22V Power Supply Adjustment Locations

5-2. 10 MHz STANDARD ADJUSTMENT, A51

Reference

Performance Test: None
Service Section: Reference — M/N Loops

Description

The internal 10 MHz time base is adjusted for frequency accuracy. This procedure does not adjust for long-term drift or aging rate. It adjusts only short-term accuracy. To properly adjust the time base, a frequency standard whose accuracy is known to be better than that of the HP 8340B/41B Time Base is required. Refer to Frequency Reference specifications in Section I, Table 1-1 for aging rate specifications for the internal time base. (Time base specifications for the HP 8340B and HP 8341B are the same.)

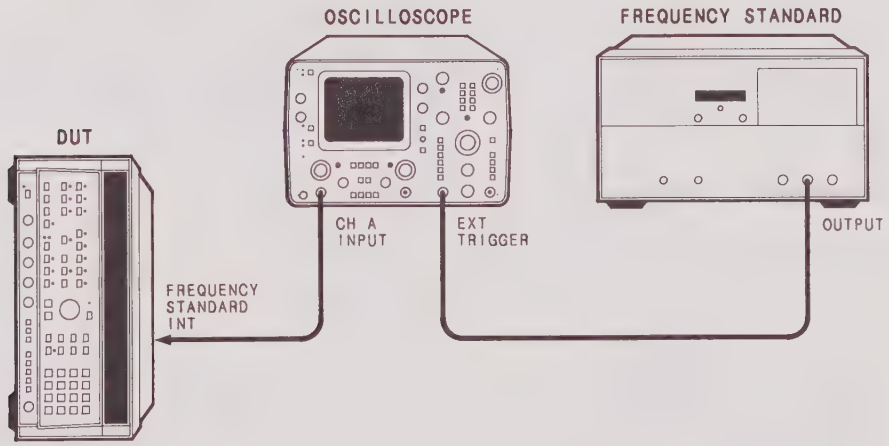


Figure 5-3. 10 MHz Standard Adjustment Setup

Equipment

Oscilloscope ..... HP 1741A
Frequency Standard ..... any 1, 2, 5, or 10 MHz Frequency Standard with aging rate of $\pm 1 \times 10^{-9}$/day or better such as HP 5061A

Procedure

NOTE

Primary power must have been applied to the instrument for at least 30 days before adjusting the internal time base. If the instrument was disconnected from ac power less than 24 hours (after it had its initial 30 day warmup), the warmup time is 24 hours before adjusting internal time base.

5-2. 10 MHz STANDARD ADJUSTMENT, A51 (Cont'd)

NOTE

If front-panel red OVEN annunciator is lighted, do not make internal time base adjustments. This annunciator lights when the oven for the reference crystal oscillator is not at operating temperature; a warm oven that suddenly goes cold has lost power and requires service. Section VIII (Service) describes the action required to repair a faulty oven.

1. Connect equipment as shown in Figure 5-3 as follows:
   a. At the DUT, disconnect jumper from rear-panel FREQUENCY STANDARD INT connector.
   b. Connect oscilloscope CH A to the DUT's FREQUENCY STANDARD INT connector. (If the oscilloscope being used does not have a 50 Ohm input, connect Channel A through a 50 Ohm feedthrough.)
   c. Set switch adjacent to the INT connector to INT position.
   d. Connect a frequency standard whose accuracy is known to be better than that of the internal time base, such as an HP 5061A Cesium Beam, to the EXT TRIGGER input of the oscilloscope.
   e. Set LINE switch to ON.
2. Set oscilloscope controls as follows:

TIME/DIV	0.05 µsec
CHAN A VOLTS/DIV	0.5
MAG x 10 pushbutton	OUT
DISPLAY A pushbutton	IN
TRIGGER COMP A/B	A
INT/EXT trigger pushbutton	IN
EXT Divide By 10	OUT
SWEEP VERNIER control	CAL
TRIGGER HOLDOFF	Fully Counterclockwise
AC/DC trigger pushbutton	OUT (AC)
POS/NEG trigger pushbutton	OUT (POS)
Main TRIGGER LEVEL control	Centered

3. Adjust Main TRIGGER LEVEL control as necessary to display sine wave signal on oscilloscope.
4. Remove dust cap screws used to seal the adjustments from A51 10 MHz Standard. Refer to Figure 5-4 for location of A51 10 MHz Standard.
5. Adjust A51 COARSE frequency adjust for minimum sideways movement of the display signal. Adjust A51 FINE frequency adjust for no sideways movement of display signal.
6. Observe the sine wave signal on the oscilloscope for 100 seconds. The sine wave trace should move less than 1 cycle or 360 degrees.
7. Disconnect oscilloscope and reinstall dust cover screws over A51 adjustments. Reconnect rear panel cable between FREQUENCY STANDARD INT and EXT connectors.

5-2. 10 MHz STANDARD ADJUSTMENT, A51 (Cont'd)

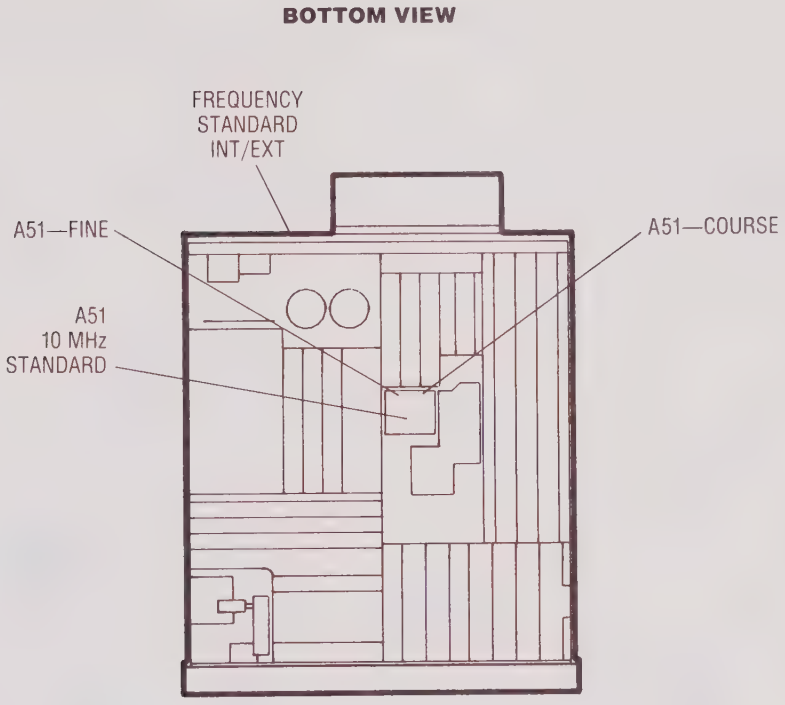


Figure 5-4. 10 MHz Standard Adjustments Location

5-3. 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO), A30

Reference

Performance Test: None
Service Section: Reference — M/N Loops

Description

The open loop frequency and maximum power output of the 100 MHz VCXO is centered around 100 MHz. The 400 MHz signal is adjusted for maximum 400 MHz output with minimum spurious output. The 400 MHz output is set to −10 dBm by selecting proper resistor values for the attenuator network A30R67, R68, and R69.

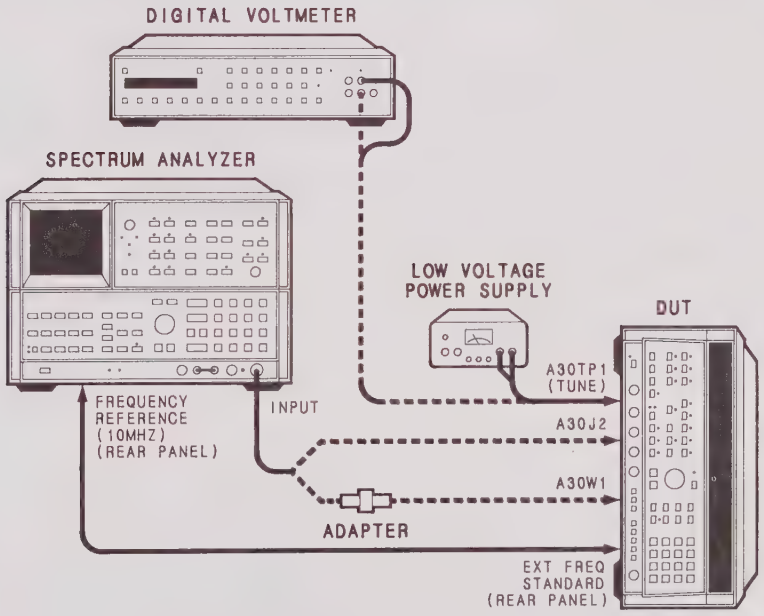


Figure 5-5. 100 MHz VCXO Adjustment Setup

Equipment

Spectrum Analyzer	HP 8566B
Digital Voltmeter	HP 3456A
Low-Voltage DC Power Supply	HP 6294A
BNC to SMB Snap-On Test Cable (2 required)	HP P/N 85680-60093
Adapter, SMB Snap-On Male-to-Male	HP P/N 1250-0069

Procedure

1. Position DUT into the Test Position as shown in Figure 5-5 with the bottom cover removed. On the DUT's rear panel, disconnect the BNC cable connected between INT and EXT Frequency Standard connectors, set INT/EXT switch to EXT, then connect a BNC cable from EXT connector to Spectrum Analyzer's Frequency Reference (10 MHz) rear-panel connector. Allow the test equipment to warm up for one-half hour.

5-3. 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO), A30 (Cont'd)

2. Set Spectrum Analyzer controls as follows:

CENTER FREQ	100 MHz
REF LEVEL	3 dBm
ATTEN	+20 dB
LOG SCALE	1 dB/DIV
RES BW	300 Hz
VBW	300 Hz
FREQ SPAN	20 kHz
SWEEP TIME	1 SEC.
MARKER ENTRY	Press PEAK SEARCH
MARKER ENTRY	Press MKR → CF
MARKER MODE	Press SIGNAL TRACK

100 MHz OUTPUT ADJUSTMENT

3. On the DUT, set LINE switch to ON and press **[INSTR PRESET]**.
4. At rear panel of the DUT, disconnect the 10 MHz Frequency Standard cable at the EXT FREQUENCY STANDARD connector.
5. Adjust the DC power supply for −8.0V, connect the ground lead to ground and the negative lead to A30TP1 (TUNE). Connect the DVM to A30TP1 (TUNE) and verify that TUNE measures −8.0V. Re-adjust the power supply if necessary.

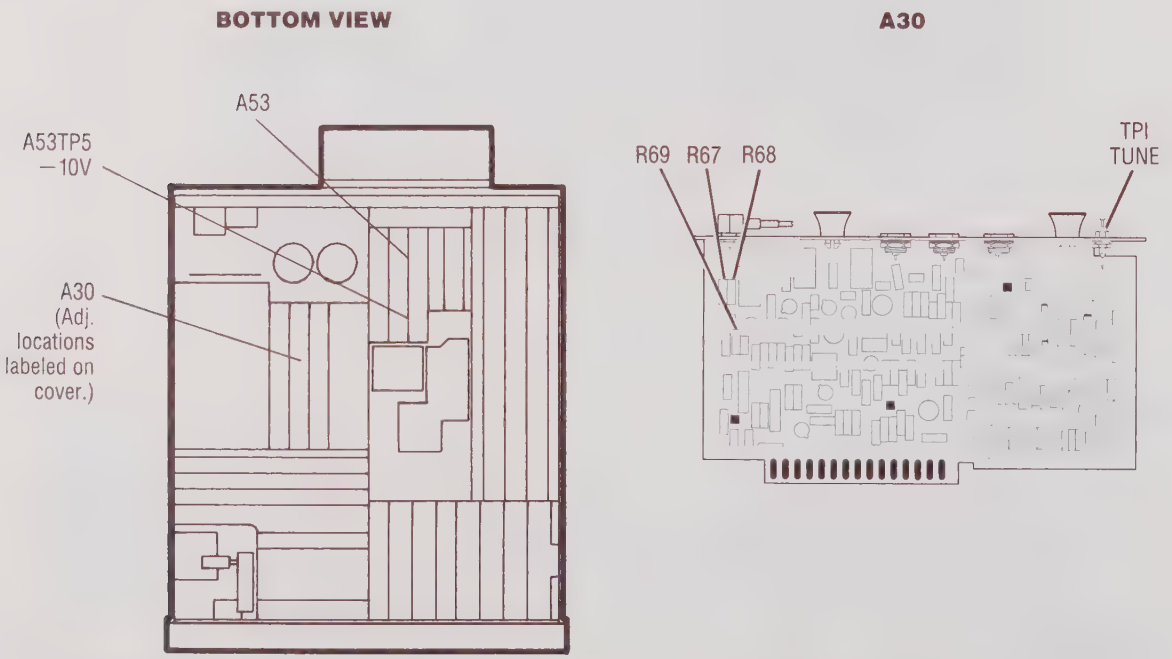


Figure 5-6. Location of A30 100 MHz VCXO Adjustments

5-3. 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO), A30 (Cont'd)

6. Disconnect cable W35 from A30J2 100 MHz OUT. Connect Spectrum Analyzer RF Input to A30J2.

7. Adjust A30C4 100 MHz ADJ through its full range while monitoring frequency indication on Spectrum Analyzer. Adjustment should provide a minimum adjustment range of plus and minus 300 Hz centered about 100 MHz. If adjustment does not provide sufficient range, select new values for factory selected components A30C8 and A30L4. A30L4 is used to center the adjustment about 100 MHz and A30C8 is used to adjust the range of A30C4. Refer to Table 5-2 for range of values. Refer to Table 5-4 for HP Part Numbers.

8. Adjust A30C4 100 MHz ADJ for Spectrum Analyzer indication of 100.0000 MHz ±0.0001 MHz.

9. Disconnect cable A30W1 at A31J1 400 MHz IN and connect the open end of this cable (A30W1) to the Spectrum Analyzer input using a BNC to SMB Snap-on test cable and SMB male-to-male adapter. Set Spectrum Analyzer controls to view a 400 MHz signal.

10. The 400 MHz output should be −10 dBm ±3 dB.

11. Adjust the DC power supply for 0V at A30TP1 (TUNE). Connect Spectrum Analyzer to A30J2. Adjust Spectrum Analyzer to view 100 MHz.

12. Frequency indication on Spectrum Analyzer should be less than 100 MHz. If not, repeat Steps 2 through 7.

13. Set power supply for an output of −25 Vdc. Verify TUNE test point A30TP1 is at −25 Vdc.

14. Frequency indication on Spectrum Analyzer should be greater than 100 MHz. If not, repeat Steps 2 through 7 and verify that the oscillator's range is 100 MHz ±300 Hz. Disconnect power supply from A30TP1. Reconnect 10 MHz signal cable from Spectrum Analyzer to the DUT's rear-panel EXT FREQUENCY STANDARD.

400 MHz OUTPUT ADJUSTMENT

15. Set Spectrum Analyzer to 500 MHz center frequency and 100 MHz frequency span per division.

16. Connect Spectrum Analyzer to A30W1 cable. Adjust A30C3, A30C2, and A30C1 400 MHz adjustments, in that order, to maximize the 400 MHz signal's output power and minimize all harmonics of 100 MHz. The 400 MHz signal should be −10 dBm ±3dB and the harmonics at 100, 300, 500, 600, 700, and 900 MHz must be greater than 40 dB down from the 400 MHz signal. Harmonics at 200 MHz must be greater than 25 dB down from the 400 MHz signal. Harmonics at 800 MHz must be greater than 15 dB down from the 400 MHz signal. It may be necessary to perform the adjustments more than once. This should be done in the order stated each time through the adjustments.

17. The amplitude of the 400 MHz signal should be −10 dBm ±3 dB. This amplitude is set by selecting attenuator network resistors A30R67, A30R68, and A30R69.

18. If the amplitude of the 400 MHz signal is not within 3 dB of −10 dBm, note the amplitude and change the values of A30R67, A30R68, and A30R69 as necessary to adjust the amplitude to −10 dBm ±3 dB. Table 5-5 contains a list of attenuations in 1 dB steps and the corresponding values for the attenuator network resistors to adjust the level to −10 dBm. Refer to Figure 5-6 for location of resistors.

5-3. 100 MHz VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO), A30 (Cont'd)

19. Check the level of the 100 MHz harmonics as displayed on the Spectrum Analyzer. Harmonics at 100, 300, 500, 600, 700, and 900 MHz must be greater than 40 dB down from the 400 MHz signal. Harmonics at 200 MHz must be greater than 25 dB down from the 400 MHz signal. Harmonics at 800 MHz must be greater than 15 dB down from the 400 MHz signal. If not, repeat step 15.

Table 5-5. Selection Chart for Attenuator Resistors

Attenuation (dB)	Resistors (Ohms)		
	R67	R68	R69
0	Open	Short	Open
1	825	6.8	825
2	422	12.1	422
3	261	17.8	261
4	215	23.7	215
5	178	31.6	178
6	162	38.3	162
7	133	46.4	133
8	121	51.1	121
9	110	61.9	110

NOTE

HP Part Numbers for resistors may be found in Table 5-5.

20. Set the DUT's LINE switch to STANDBY. Disconnect equipment from the DUT and reconnect the two cables. Disconnect the 10 MHz Frequency Standard cable at the rear of the DUT, reconnect jumper cabled between INT and EXT, and set switch to INT. Set the DUT's LINE switch to ON.

5-4. M/N LOOP, A32, A33, and A32A1

Reference

Performance Test: Frequency Range and CW Mode Accuracy
Service Section: Reference — M/N Loops

Description

The M/N VCO tuning range is centered and the output level is set and checked to ensure an adequate RF output level across the band of the M/N output.

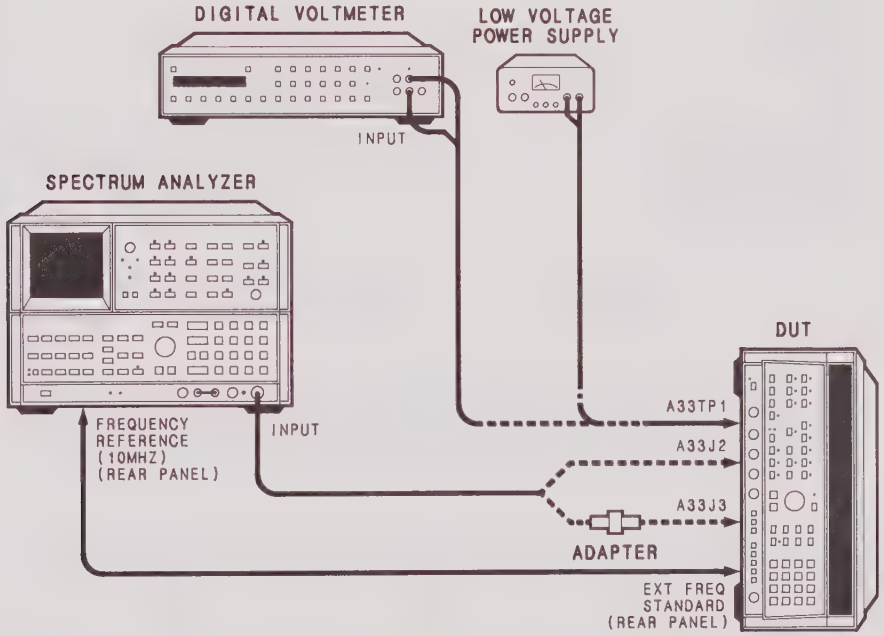


Figure 5-7. M/N Loop Adjustment Setup

Equipment

Spectrum Analyzer	HP 8566B
Digital Voltmeter (DVM)	HP 3456A
Low-Voltage DC Power Supply	HP 6294A
BNC to SMB Snap-On Test Cable	HP P/N 85680-60093
Adapter, SMB Snap-On Male-to-Male	HP P/N 1250-0069

Procedure

1. Position the DUT in the test position as shown in Figure 5-7 with bottom cover removed. On the DUT's rear panel, disconnect the BNC cable connected between INT and EXT Frequency Standard connectors, set INT/EXT switch to EXT, then connect a BNC cable from the DUT's EXT connector to Spectrum Analyzer Frequency Reference (10 MHz) rear-panel connector. Allow one-half hour warm up time.

5-4. M/N LOOP, A32, A33, AND A32A1 (Cont'd)

2. Set LINE switch to ON and press **[INSTR PRESET]**. Connect a jumper between A59TP4 DL1 and A59TP5 +5V to disable the UNLK indicator circuit.

3. Press **[CW]** on the DUT, then enter **[6] [0] [9] [0] [MHz]**.

4. Disconnect the cable from A33J2 M/N OUT and connect this output to Spectrum Analyzer RF INPUT. Set the Spectrum Analyzer as follows:

CENTER FREQ	197.419 MHz
REF LEVEL	3 dBm
ATTEN	+20 dB
LOG SCALE	1 dB/DIV
RES BW	300 Hz
VBW	300 Hz
FREQ SPAN	5 kHz
SWEEP TIME	1 SEC.
MARKER ENTRY	Press PEAK SEARCH
MARKER ENTRY	Press MKR → CF
MARKER MODE	Press SIGNAL TRACK

5. The M/N output frequency indicated on Spectrum Analyzer should be 197.419 MHz ±1 count.

NOTE

To display the frequencies that the processor programs, press [SHIFT] [M1] on the DUT. It will display from left to right: the M divide number, the N divide number, the M/N output frequency, and the 20/30 output frequency.

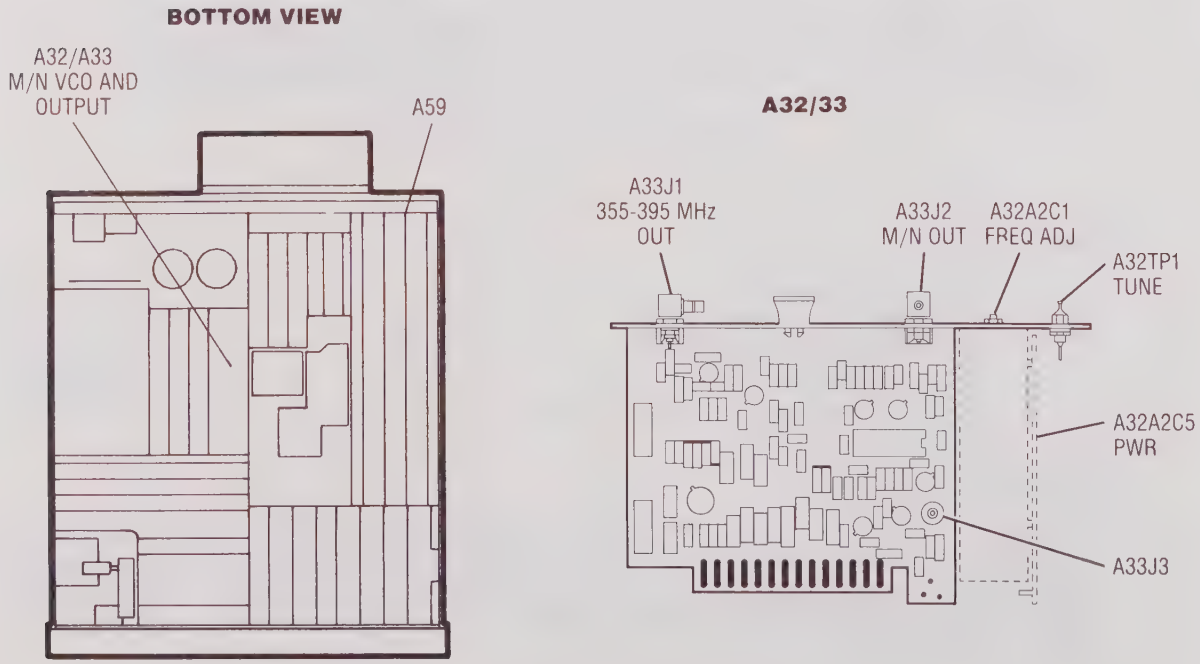


Figure 5-8. Location of M/N Loop Adjustments

5-4. M/N LOOP, A32, A33, AND A32A1 (Cont'd)

6. Connect DVM to A32TP1 TUNE test point. Refer to Figure 5-8 for location of A32 assembly.

7. Loosen locknut on A32A2C1 FREQ ADJ control and adjust A32A2C1 for a DVM reading of −35.0 Vdc ±0.5 Vdc. Retighten A32A2C1 locknut. Verify that DVM reading is still within tolerance.

8. Press **[CW]** on the DUT, then enter **[2] [3] [0] [0] [MHz]**.

9. Turn the Spectrum Analyzer's Signal Track off and then set the Spectrum Analyzer for a Center Frequency of 179.230 MHz. Turn the Signal Track on. The frequency indicated on Spectrum Analyzer should be 179.230 MHz ±1 count and the DVM should read −2.8 Vdc ± 1.0 Vdc.

10. Set the DUT's LINE switch to STANDBY.

11. Disconnect the DVM from the A32 assembly. Remove the A32/A33 assembly from the instrument and place it on an extender board.

12. Disconnect the A32 output cable A32A1W1 from A33J3 (Figure 5-8) and connect this cable using SMB male-to-male adapter to the input of the Spectrum Analyzer. Set the DUT's LINE switch to ON and press **[INSTR PRESET]**.

13. Turn the Spectrum Analyzer's Signal Track off and then set the Spectrum Analyzer Center Frequency to 375 MHz, the Frequency Span to 100 MHz, Log Scale 5dB/Division, and the Reference Level to +5 dBm.

CAUTION

Do not apply a positive voltage to A32TP1 or damage may occur to the VCO tuning diodes.

14. Connect the low-voltage power supply to the DUT as follows: Positive lead to ground (do this first). Negative lead to A32TP1 TUNE test point. Set the output of the supply for −35.0 Vdc ±0.5 Vdc.

15. Adjust A32A2C5 PWR for a VCO output level of 0 dBm ±2 dB as indicated on Spectrum Analyzer. Refer to Figure 5-8 for location of adjustment.

16. Slowly reduce the voltage output of the external low-voltage power supply connected to A32TP1 TUNE test point while monitoring the VCO output level on the Spectrum Analyzer and voltage level on DVM.

17. The VCO output level should be greater than −2 dBm between 395 MHz (−35 Vdc) and 355 MHz (−2.8 Vdc).

18. Repeat Steps 2 through 9 to check frequency accuracy.

19. Set the DUT's LINE switch to STANDBY. Disconnect all the test equipment from the A32/A33 assembly. Reconnect the cable A32A1W1 to A33J3.

20. Reinstall the A32/A33 M/N Output Assembly and remove the jumper from A59TP4 to A59TP5 (UNLK indicator disable).

21. Disconnect the cable from the DUT's rear-panel EXT FREQUENCY STANDARD, reconnect the BNC cable between the INT and EXT connectors, and set the adjacent switch to INT.

5-5. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43

Reference

Performance Test: Frequency Range and CW Mode Accuracy
Service Section: 20/30 Loops

Description

hase Lock Loop 2 is adjusted by selecting a very narrow span width and adjusting A40 and A43 for proper voltages at designated test points. If PLL2 will not phase lock (UNLK indicator is lit and **[SHIFT] [EXT]** diagnostic indicates N2 is at fault), the A41 PLL2 Phase Detector must be disabled and a slightly different procedure used to initially set the A40 and A43 adjustments.

Phase Lock Loop 3 is adjusted for maximum multiplier output level at 160 MHz. The VCO is adjusted by setting up proper voltage levels at A39TP3.

Phase Lock Loop 1 40 kHz LPF is properly adjusted using a function generator and spectrum analyzer with an active probe. The response of PLL1 is adjusted for maximum rejection of signals between 160 and 166 MHz using a signal generator and spectrum analyzer.

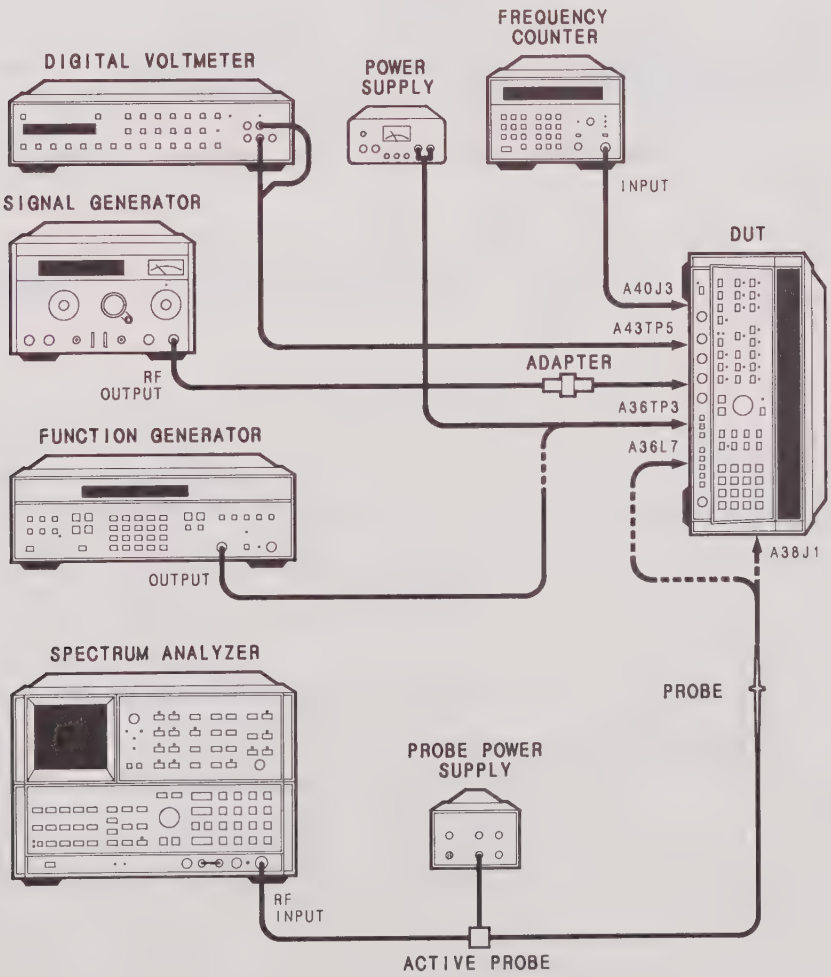


Figure 5-9. 20/30 Loop Phase Lock Adjustments Setup

5-5. 20/30 LOOP PHASE LOCK, A36, A38, A39, AND A43 (Cont'd)

Equipment

Frequency Counter	HP 5343A
Spectrum Analyzer	HP 8566B
Active Probe	HP 1121A
Probe Power Supply	HP 1122A
Signal Generator	HP 8654A
Low-Voltage DC Power Supply	HP 6294A
Digital Voltmeter (DVM)	HP 3456A
Function Generator	HP 3325A
BNC to SMB Snap-On Test Cable	HP 85680-60093
Adapter, SMB Snap-On Male-to-Male	HP 1250-0069

Procedure

PHASE LOCK LOOP 2

NOTE

If PLL2 is phase locked (UNLK annunciator not lit), proceed to step 12. If the UNLK annunciator is lit, determine if PLL2 (N2) is phase locked as follows: (a) Press [SHIFT] then [EXT], (b). Observe ENTRY display and if N2 is blinking, PLL2 is unlocked. With PLL2 unlocked, proceed to step 1. If some other oscillator circuit caused the UNLK indication, proceed to step 12.

1. Position the DUT in test position as shown in Figure 5-9 with bottom cover removed and allow one-half hour warm up time. Set LINE switch to STANDBY. Remove A41 PLL2 Phase Detector from its connector on the motherboard. (It is not necessary to completely remove the A41 assembly from the instrument).
2. Set the LINE switch to ON and press **[INSTR PRESET]**.
3. Remove the cable from A40J3 (.15 - 6 MHz OUT FOR $\Delta F \leq .1$ MHz) and connect the Frequency Counter to A40J3 using a BNC to SMB snap-on test cable.
4. Press **[CW]** then enter **[3] [0] [MHz]** to set the N2 oscillator to 150 MHz.
5. Connect the DVM to A43TP5 (VCO TUNE) located on top cover of A43.
6. Adjust A40R2 (150 MHz) for a DVM indication of $+3.0$ Vdc ± 0.5 Vdc. Refer to Figure 5-10 for location of adjustments.
7. Adjust A43R9 (.3 MHz) for a DVM indication of 0.300 MHz ± 0.001 MHz (N2 frequency divided by 500).
8. Press **[CW]** then enter **[1] [9] [.] [9] [9] [9] [9] [9] [9] [MHz]** to set the N2 oscillator to 100 MHz.
9. Adjust A40R4 (100 MHz) for a DVM indication of $+15.0$ Vdc ± 0.5 Vdc.
10. Adjust A43R41 (.2 MHz) for a frequency Counter indication of 0.200 MHz ± 0.001 MHz (N2 frequency divided by 500).

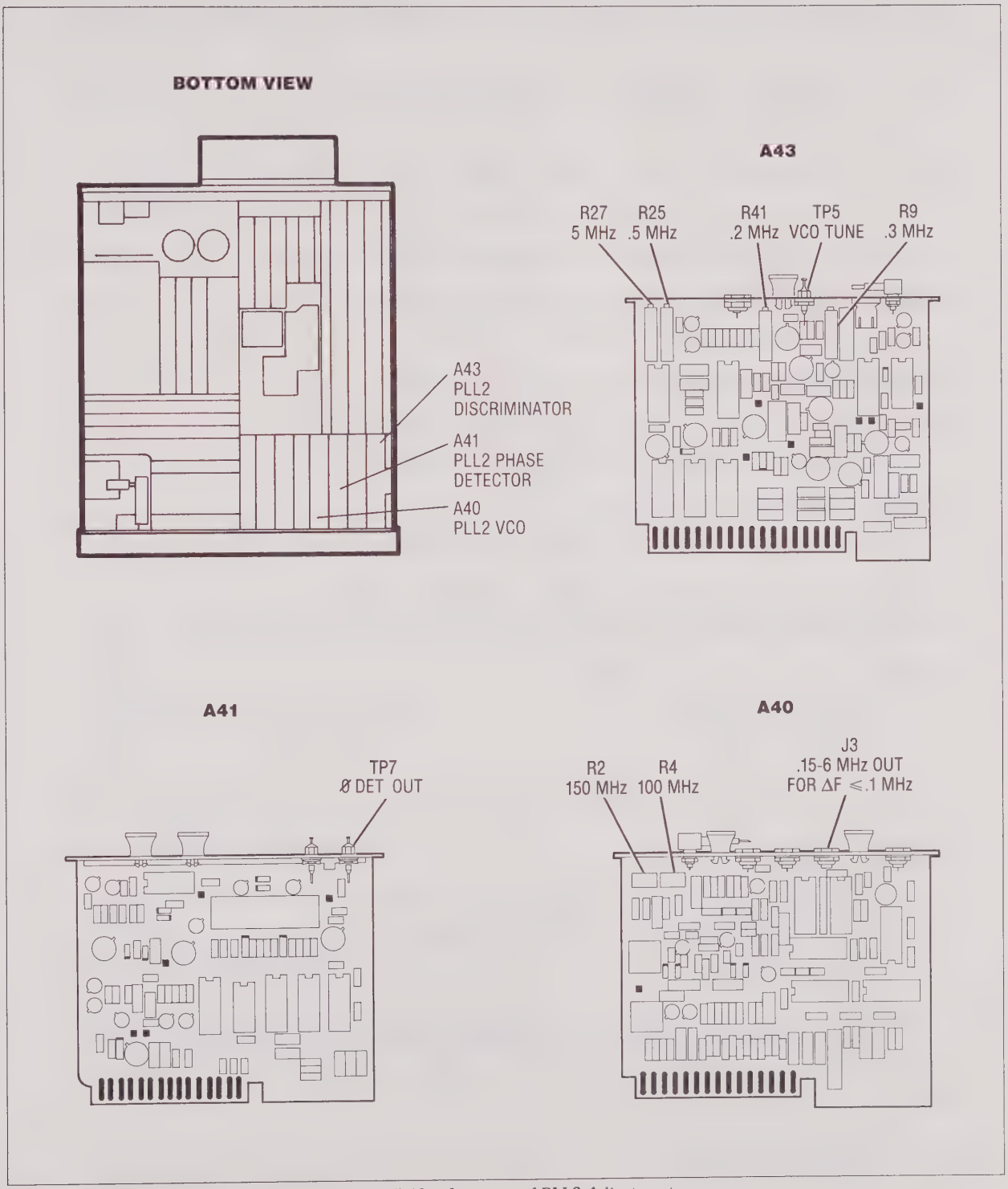


Figure 5-10. Location of PLL2 Adjustments

5-5. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

11. Set the LINE switch to STANDBY. Reinstall A41 (PLL2 Phase Detector). Disconnect the Frequency Counter from A40J3 and reconnect the A39W1 cable to A40J3 (.15 - 6 MHz OUT FOR $\Delta F \leq .1MHz$) connector.

12. Set the LINE switch to ON. Press **[INSTR PRESET]**.

13. Press **[CW]** then enter **[3] [0] [MHz]** to set the N2 oscillator to 150 MHz.

14. Connect the DVM to A43TP5 (VCO TUNE) located on the top cover of A43.

15. Adjust A40R2 (150 MHz) for a DVM indication of $+3.00$ Vdc ± 0.05 Vdc.

16. Connect the DVM to A41TP7 (ϕ DET OUT) on the top cover of A41.

17. Adjust A43R9 (.3 MHz) for a DVM indication of $+3.50$ Vdc $\pm$ 0.05 Vdc.

18. Press **[CW]** then enter **[1] [9] [.] [9] [9] [9] [9] [9] [9] [MHz]** to set the N2 oscillator to 100 MHz.

19. Connect the DVM to A43TP5 (VCO TUNE) located on the top cover of A43.

20. Adjust A40R4 (100 MHz) for a DVM indication of $+15.00$ Vdc ± 0.05 Vdc.

21. Connect the DVM to A41TP7 (ϕ DET OUT) located on the top cover of A41.

22. Adjust A43R41 (.2 MHz)for a DVM indication of 3.50 Vdc ± 0.05 Vdc.

23. Repeat Steps 12 through 22 until no further adjustment is required.

24. Set the Spectrum Analyzer as follows:

    a. Press **[INSTR PRESET]**
    b. Set CENTER FREQ to 29.5 MHz
    c. Set SPAN to 200 kHz

25. Connect jumper between A59TP4 (DL1) and A59TP5 ($\pm 5V$) to disable the UNLK indicator circuit.

26. Set the DUT as follows:

    a. Press **[INSTR PRESET]**
    b. Press **[START FREQ]** then enter **[2] [0] [MHz]**
    c. Press **[STOP FREQ]** then enter **[2] [0] [.] [5] [MHz]**
    d. Press **[SHIFT]**, then **[XTAL]** (This stops the frequency at end of the sweep without a retrace.)
    e. Press **[SINGLE]** Sweep

27. Disconnect the cable W39 from A36J1 (OUT 20-30 MHz) and connect the Spectrum Analyzer (RF INPUT) to A36J1 through an SMB snap-on to BNC cable. Adjust A43R25 (0.5 MHz ΔF) to center the signal on the Spectrum Analyzer screen.

28. Set the Spectrum Analyzer as follows:

    a. Set CENTER FREQ to 25 MHz
    b. Set SPAN to 500 kHz

5-5. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

29. Set the DUT as follows:

    a. Press **INSTR PRESET]**
    b. Press **[START FREQ]** then enter **[2] [0] [MHz]**
    c. Press **[STOP FREQ]** then enter **[2] [5] [MHz]**
    d. Press **[SHIFT]**, then **[XTAL]**
    e. Press **[SINGLE]** Sweep

30. Adjust A43R27 (5 MHz ΔF) to center the signal on the Spectrum Analyzer screen.

31. Disconnect the Spectrum Analyzer from A36J1 and reconnect W39 to A36J1 (OUT 20-30 MHz).

PHASE LOCK LOOP 3

32. Set the LINE switch to STANDBY. Remove A39 (PLL3 Up Converter) and install it on an extender board.

33. Set the LINE switch to ON. Press **[INSTR PRESET]**. Press **[CW]** then enter **[5] [GHz]**. Press **[SHIFT] [M3]** to display the PLL2 and PLL3 frequencies.

34. Connect the Spectrum Analyzer to the Test Connector A39J3 on the P.C. board. Tune the Spectrum Analyzer center frequency to 160 MHz. Set the reference level to −20 dBm and set the scale to 1 dB per division.

35. Adjust A39L16, A39L17, and A39C50 (160 MHz PEAK) for maximum signal level at 160 MHz. Iteration of L16 and L17 adjustment may be necessary. Refer to Figure 5-11 for location of adjustments.

    If A39C50 does not have sufficient range, select the value of A39C49 for proper range. (Refer to Table 5-2.)

36. At the DUT, select the following:

    a. Press **[CF]** then enter **[6] [.] [6] [2] [7] [2] [5] [0] [GHz]**.
    b. Press **[ΔF]** then enter **[1] [0] [0] [kHz]**.
    c. Press **[SINGLE]** Sweep

37. Tune the Spectrum Analyzer to a center frequency of 6 MHz. Set the scale to 10 dB per division.

38. The 6 MHz signal displayed should be at least −42 dBm. If not, repeat Steps 33 through 37.

39. Connect the DVM to A39TP3.

40. Adjust A39L11 (PLL3 VCO ADJ) for a DVM indication of −7.5 Vdc ±0.1 Vdc. The voltage may not change with initial adjustment but will change once the phase lock loop locks.

41. Press **[CF]** on the DUT then enter **[5] [GHz]**. Press **[SINGLE]** SWEEP to initiate a sweep.

42. The DVM indication should be −6.7 Vdc ±0.5 Vdc.

43. Set the LINE switch to STANDBY. Disconnect the test equipment and reinstall A39 (PLL3 UP Converter) in the instrument.

PHASE LOCK LOOP 1

44. Set the LINE switch to STANDBY. Place A36 (PLL1 VCO) on an extender board. Remove all cables connected to A36.

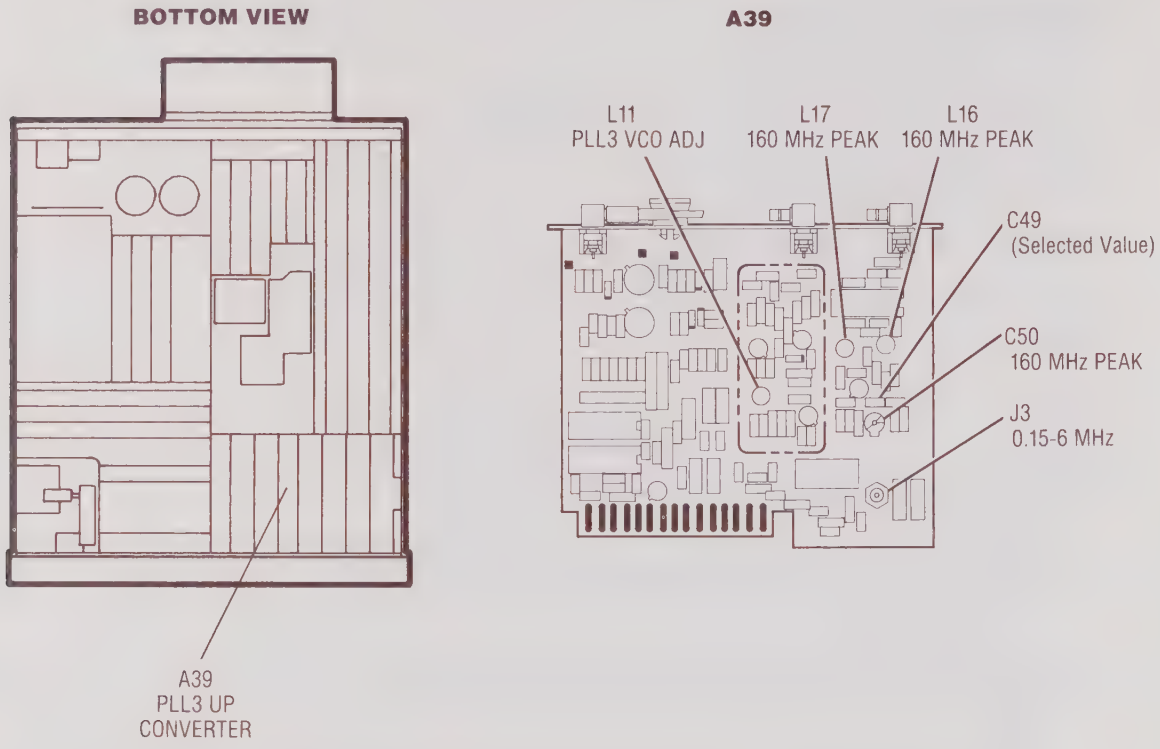


Figure 5-11. Location of PLL3 Adjustments

45. Set the Function Generator controls as follows:

FUNCTION	Sine Wave
FREQ	20 kHz
AMPL	−7.7 dBm

46. Set the Spectrum Analyzer controls as follows:

INSTR PRESET	Press
START FREQ	10 kHz
STOP FREQ	60 kHz
REFERENCE LINE	0 dBm
RES BW	300 Hz
VIDEO BW	1 kHz
SWEEP TIME	1.2 SEC
SCALE	10 dB/DIV
MARKER MODE	NORMAL

47. Set the Spectrum Analyzer Marker to 20 kHz.

48. Connect the active probe to the Spectrum Analyzer input and connect the probe to the output of the 40 kHz LPF on A36 (see Figure 5-13). (This is the terminal on A36L7 next to A36C24.)

5-5. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

49. Connect the Function Generator to A36TP3. Adjust the Function Generator amplitude to place the 20 kHz signal displayed on the Spectrum Analyzer at the 0 dBm reference line.

50. Set the Function Generator to 50 kHz.

51. Set the Spectrum Analyzer Marker at 50 kHz.

52. Adjust A36L7 and A36L8 (50 kHz NULL) to null the 50 kHz signal displayed on the Spectrum Analyzer. Refer to Figure 5-12 for location of adjustments.

53. Note the level of the 50 kHz signal. This level should be at least 65 dB down from the level of the 20 kHz response. Disconnect the test equipment from the A36 assembly.

54. Disconnect the active probe from the Spectrum Analyzer and connect the Spectrum Analyzer input to A36J2 (OUT 200-300 MHz) using a BNC to SMB snap-on test cable. Set the LINE switch to ON.

55. Set the Spectrum Analyzer as follows:

INSTR PRESET	Press
START FREQ	150 MHz
STOP FREQ	470 MHz
REF LINE	+10 dBm
MARKER	PEAK SEARCH

56. Connect an external low-voltage dc power supply positive lead to A36TP3 and the negative lead to any convenient chassis ground. Set the external power supply for +16.0 Vdc ± 0.1 Vdc.

57. The Oscillator frequency should be 310 MHz ±10 MHz as indicated on the Spectrum Analyzer. If not, remove the metal shield from A36 and increase or decrease the spacing between turns of A36L4 and increase or decrease the area of the single turn of A36L5 to properly tune the oscillator.

58. Change the power supply voltage to +4.0 Vdc ±0.1 Vdc.

59. The Oscillator frequency should drop below 200 MHz with an amplitude greater than −7 dBm.

60. Repeat Steps 56 through 59 if necessary to meet requirements.

61. Set the LINE switch to STANDBY. Reinstall the metal shield on A36 if it was removed, reinstall A36 (PLL1 VCO) in the instrument, and reconnect all cables.

62. Remove A38 (PLL1 IF) from the instrument and install it on an extender board. Connect all the cables to A38.

63. Set the LINE switch to ON and press **[INSTR PRESET]**. Press **[CW]** then enter **[1] [3] [.] [9] [7] [MHz]**.

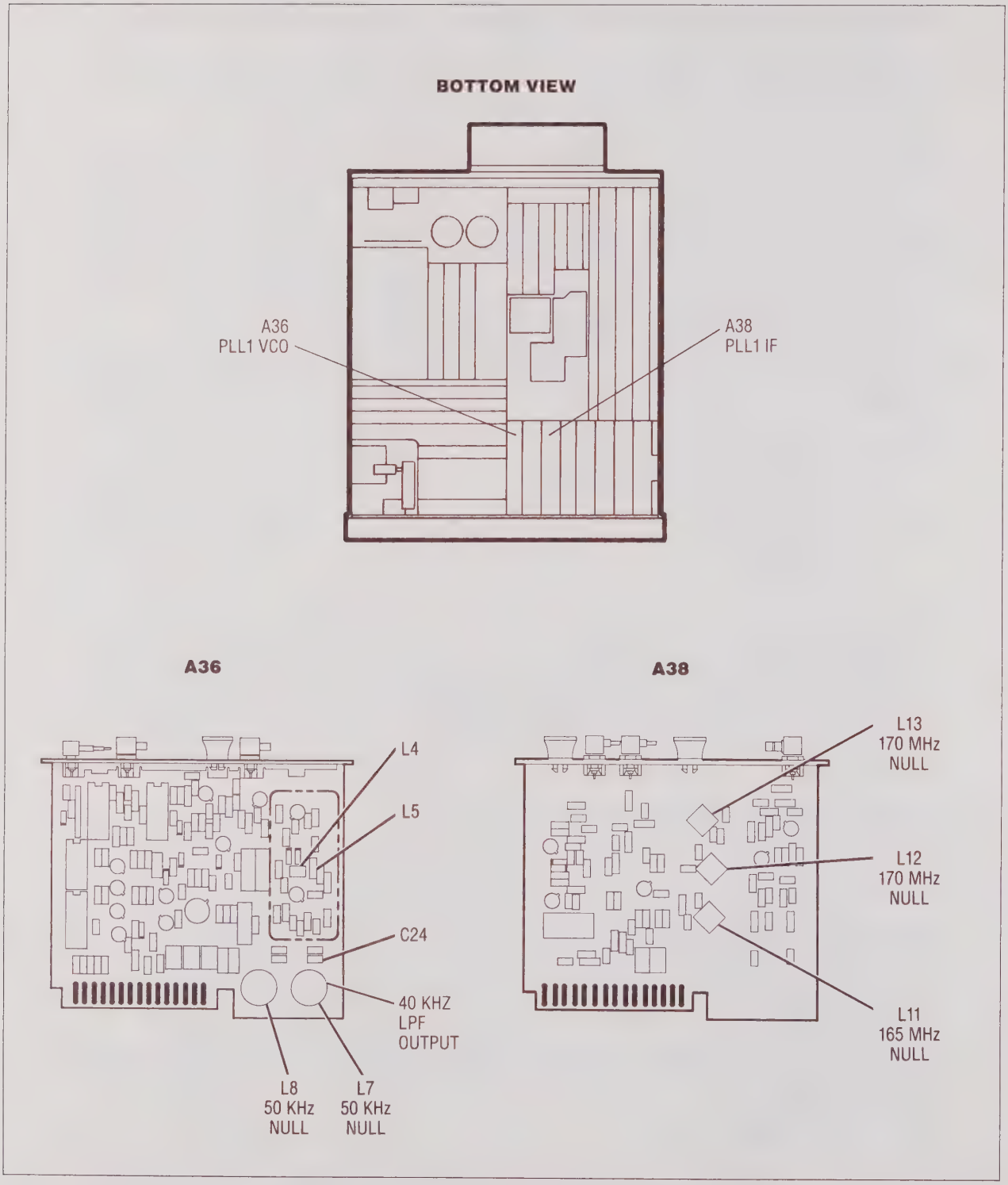


Figure 5-12. Location of PLL1 Adjustments

5-5. 20/30 LOOP PHASE LOCK, A36, A38, A39, A40, AND A43 (Cont'd)

64. Connect the Spectrum Analyzer to A38J1 (OUT PLL1) IF. Set the Spectrum Analyzer controls as follows:

INSTR PRESET	Press
CENTER FREQ	170 MHz
FREQ SPAN	200 kHz
RES BW	3 kHz
VBW	3 kHz
SWP	100 ms
REF LEVEL	−10 dBm
ATT	0 dB
SCALE/DIV	10 dB/DIV
MARKER	NORMAL

65. Disconnect the cable from A36J2 (OUT 200 - 300 MHz) and connect the cable to the Signal Generator using a BNC to SMB snap-on test cable and adapter.

66. Adjust A38L11 (165 MHz NULL), A38L12 (160 MHz NULL), and A38L13 (170 MHz NULL) fully clockwise.

67. Set the Signal Generator for an output of 330.3 MHz ±0.2 MHz at 0 dBm.

68. Adjust A38L13 (170 MHz NULL) to null the 170 MHz signal on the Spectrum Analyzer.

69. Change the Signal Generator frequency to 325.3 MHz ±0.2 MHz. Set the Spectrum Analyzer CENTER FREQ to 165 MHz.

70. Adjust A38L11 (165 MHz NULL) to null the 165 MHz signal on the Spectrum Analyzer.

71. Change the Signal Generator frequency to 320.3 MHz ± 0.2 MHz. Set the Spectrum Analyzer CENTER FREQ to 160 MHz.

72. Adjust A38L12 (160 MHz NULL) to null the 160 MHZ signal on the Spectrum Analyzer.

73. Set the Spectrum Analyzer CENTER FREQ to 140 MHz. Tune the Signal Generator to 300.3 MHz ±0.2 MHz. Note the amplitude of the 140 MHz response on the Spectrum Analyzer.

74. Set the Spectrum Analyzer as follows:

INSTR PRESET	Press
START FREQ	130 MHz
STOP FREQ	170 MHz
MARKER	NORMAL
MARKER frequency	140 MHz

Slowly tune the Signal Generator from 320.3 to 326.3 MHz while monitoring the display on the Spectrum Analyzer.

75. The amplitude of the signal response between 160 and 166 (Signal Generator frequency of 320.3 to 326.3 MHz) should be at least 60 dB below the response at 140 MHz (Signal Generator frequency of 300.3 MHz) noted in Step 73.

76. Set the LINE switch to STANDBY. Reinstall A38 (PLL1 IF) in the instrument and reconnect all the cables.

5-6. YO PRETUNE DAC, A54

Reference

Performance Test: None
Service Section: Sweep Generator — YO Loop

Description

This procedure makes gain and offset adjustments to the pretune voltage such that the lowest output voltage from the DAC will tune the YO to its lowest frequency (2.3 GHz), and the highest voltage out of the DAC (full scale) will tune the YO to its highest frequency (7 GHz).

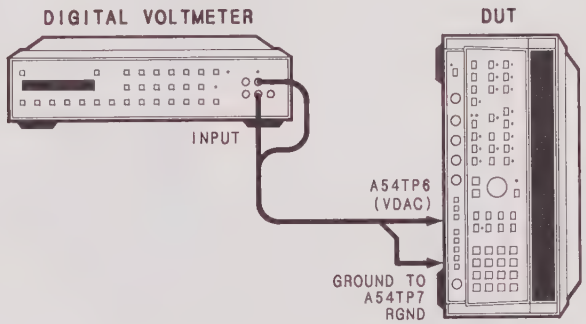


Figure 5-13. YO Pretune DAC Gain Test Setup

Equipment

Digital Voltmeter (DVM) ..... HP 3456A

Procedure

1. Position the DUT in the test position as shown in Figure 5-13 with bottom cover removed and turn the LINE switch on. Connect the test equipment as shown in Figure 5-13 and allow one-half hour warm up time. Be sure to connect DVM ground to A54TP7 RGND.

2. Set the DUT as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[CW]** then enter **[2] [.] [3] [GHz]** to tune the YO to 2.3 GHz (minimum DAC output).

3. Connect the DVM to A54TP6 (VDAC) and adjust A54R22 (POFF, Figure 5-14) for −5.75 ±0.001 Vdc.

4. Press **[CW]** on the DUT, then enter **[6] [9] [9] [9] [.] [9] [9] [9] [9] [9] [MHz]** to set the YO close to 7 GHz (maximum DAC output).

5. Adjust A54R14 (PGN, Figure 5-14) for −17.5 ±0.001 Vdc.

5-6. YO PRETUNE DAC, A54 (Cont'd)

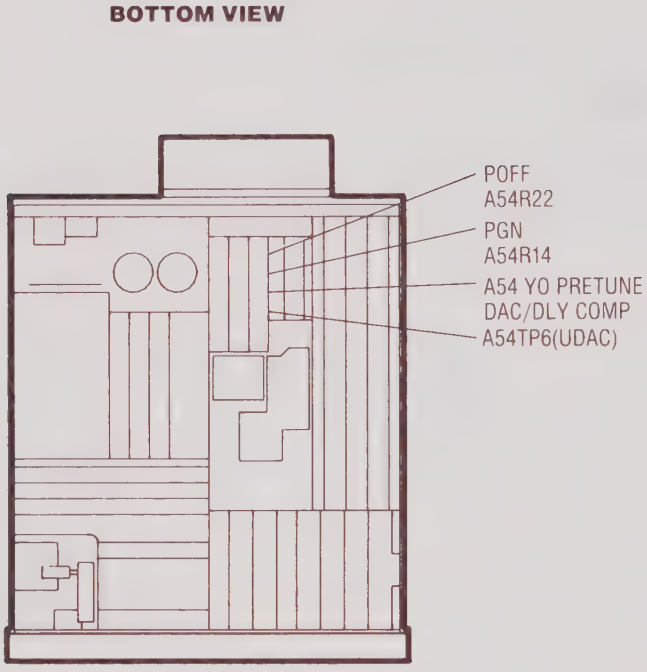


Figure 5-14. YO Pretune DAC Gain Adjustments Location

5-7. YO MAIN DRIVER, A55

Reference

Performance Test: None
Service Section: Sweep Generator — YO Loop

Description

The Main Coil Driver circuit gain and offset are adjusted for the correct output frequency.

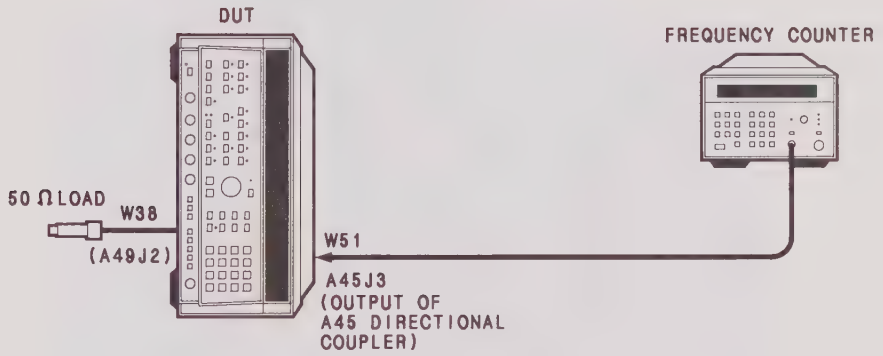


Figure 5-15. YO Main Driver A55 Test Setup

Equipment

Frequency Counter	HP 5343A
50Ω Termination, SMB(f)	HP P/N 1250-0676
Adapter, SMB (m) to SMB (m)	HP P/N 1250-0669

Procedure

1. Position the DUT in the test position as shown in Figure 5-15 with top and bottom covers removed. Remove W3 (Figure 5-17) and connect the frequency counter to W51 as shown in Figure 5-15. Allow one-half hour for warm up time.
2. Remove cable W38 from A49J2 and connect a 50 Ohm load to the end of the cable.
3. Set the DUT as follows:
   a. Press **[INSTR PRESET]**
   b. Press **[CW]** then enter **[2] [.] [3] [GHz]**.
4. Adjust A55R47 (OFFSET, Figure 5-16) for an indication of 2.3 GHz ±1 MHz on the Frequency Counter.
5. Press the DUT's **[CW]** key, then enter **[6] [.] [9] [9] [9] [GHz]**.
6. Adjust A55R4 (GAIN, Figure 5-16) for an indication of 6.999 GHz ±1 MHz on the Frequency Counter.

5-7. YO MAIN DRIVER, A55 (Cont'd)

7. Repeat steps 3 through 6 until no further adjustments are necessary.

8. Disconnect the Frequency Counter and reconnect W3 to W51 (Figure 5-17). Remove 50 Ohm load from cable W38 and reconnect the cable to A49J2.

BOTTOM VIEW

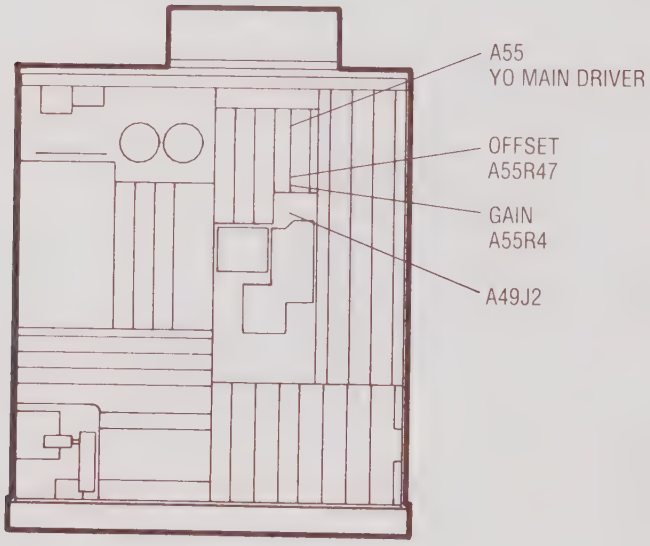


Figure 5-16. YO Main Driver A55 Adjustments Location

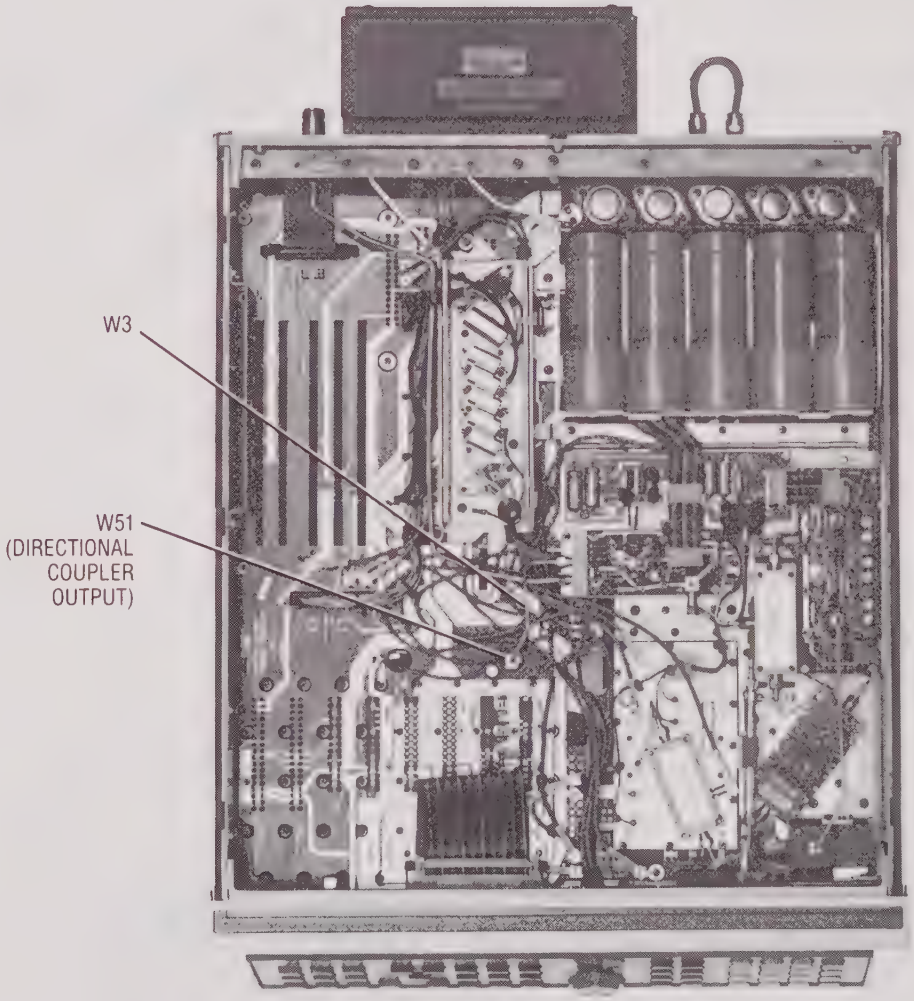


Figure 5-17. Top View, Cable Location

5-8. YO LOOP ADJUSTMENTS

Reference

Performance Test: None
Service Section: Sweep Generator - YO Loop

Description

The YO Loop Adjustment procedure adjusts the sampler drive circuitry and the IF gain.

The YO Loop gain and phase margin adjustment selects the value of resistor A49R18 to place the YO Loop gain and phase within specified limits. This prevents the YO Loop from oscillating while still providing sufficient gain in the YO Loop.

NOTE

The YO frequency adjustment in Paragraph 5-28 must be completed before these adjustments are made.

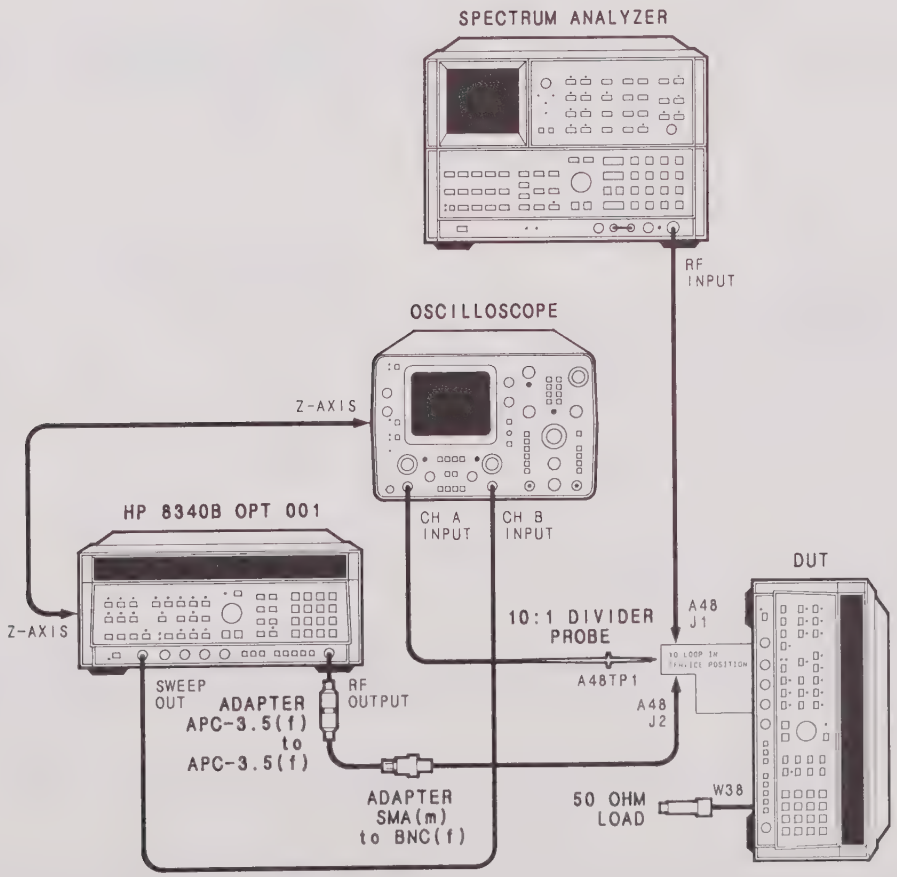


Figure 5-18. YO Loop Adjustment Setup

5-8. YO LOOP ADJUSTMENTS (Cont'd)

Equipment

Spectrum Analyzer	HP 8566B
Spectrum Analyzer	HP 3585A
Synthesized Sweeper	HP 8340B Option 001
Oscilloscope	HP 1741A
10:1 Divider Probe	HP 10004D
BNC to SMB Snap-On Test Cable (2 required)	HP P/N 85680-60093
50Ω Termination, SMB (f)	HP P/N 1250-0676
Adapters:	
APC 3.5 (f) to APC 3.5 (f)	HP P/N 5061-5311
SMA (m) to BNC (f)	HP P/N 1250-1200
SMB (m) to SMB (m)	HP P/N 1250-0669
Special Test Fixture	Fabricated Locally

Procedures

YO LOOP RESPONSE ADJUSTMENT

1. Place the DUT in the test position shown in Figure 5-18 and remove the top and bottom covers. Disconnect the rigid cable (W3) going into the A45 Directional Coupler RF Output through a hole in the mother board (top of the DUT). Put the YO Loop section in the Service Position. Disconnect all the cables that connect to A48 and A49 PC boards. Remove the A48 YO Loop Sampler assembly cover. Connect a 50 Ohm load to W38 at the end that connects to A49J2.

2. Connect the test equipment as shown in Figure 5-18 (do not connect the Spectrum Analyzer yet). Set the LINE switch to ON and allow ½ hour warmup.

3. Set the Sweep Generator as follows:

   a. Press **[INSTR PRESET]**.
   b. Press **[CF]** (center frequency) **[1] [8] [7] [MHz]**
   c. Press **[ΔF]** then enter **[2] [0] [0] [MHz]**
   d. Press **[POWER LEVEL]** then enter **[3] [dBm]**
   e. Press **[SWEEP TIME]** then enter **[1] [0] [msec]**.

4. Set the oscilloscope controls as follows:

   a. Select A vs B mode
   b. Set Channel A to 0.05 VOLTS/DIV (with 10:1 Probe)
   c. Set Channel B to 1 VOLT/DIV (typically)
   d. Select DC coupled on both channels.

5. On the oscilloscope, adjust channel B VOLTS/DIV (used as horizontal gain in A vs. B mode) for a trace of 10 horizontal divisions on the screen. Adjust the oscilloscope POSITION control to center the display trace.

6. On the Sweep Generator press **[M1]** and enter **[1] [6] [0] [MHz]**. Press **[M2]** and enter **[2] [1] [0] [MHz]**.

7. Adjust A48C1 and A48C2 (Figure 5-19) for a trace on the oscilloscope similar to Figure 5-20. Adjust for the flattest response from 160 MHz to 210 MHz. The amplitude of the response should be at least 0.4 Volts peak-to-peak.

5-8. YO LOOP ADJUSTMENTS (Cont'd)

IF GAIN ADJUSTMENT

8. Verify that the 50 Ohm load is still connected to W38 at the end that was connected to A49J2. Disconnect the oscilloscope probe from A48TP1.

9. Connect the Spectrum Analyzer to A48J1.

10. Set the DUT as follows:

    a. Press **[INSTR PRESET]**
    b. Press **[CW]** then enter **[4] [.] [5] [GHz]**
    c. Connect a jumper between A59TP4 and A59TP5. (This disables the UNLK annunciator circuit.)

11. Set the Sweep Generator as follows:

    a. Press **[INSTR PRESEST]**
    b. Press **[POWER LEVEL]** then enter **[3] [dBm]**
    c. Press **[CW]** then enter **[1] [8] [6] [MHz]**
    d. Press **[SHIFT]** then **[CW]**; press **[STEP]** keys to select 1 kHz resolution.

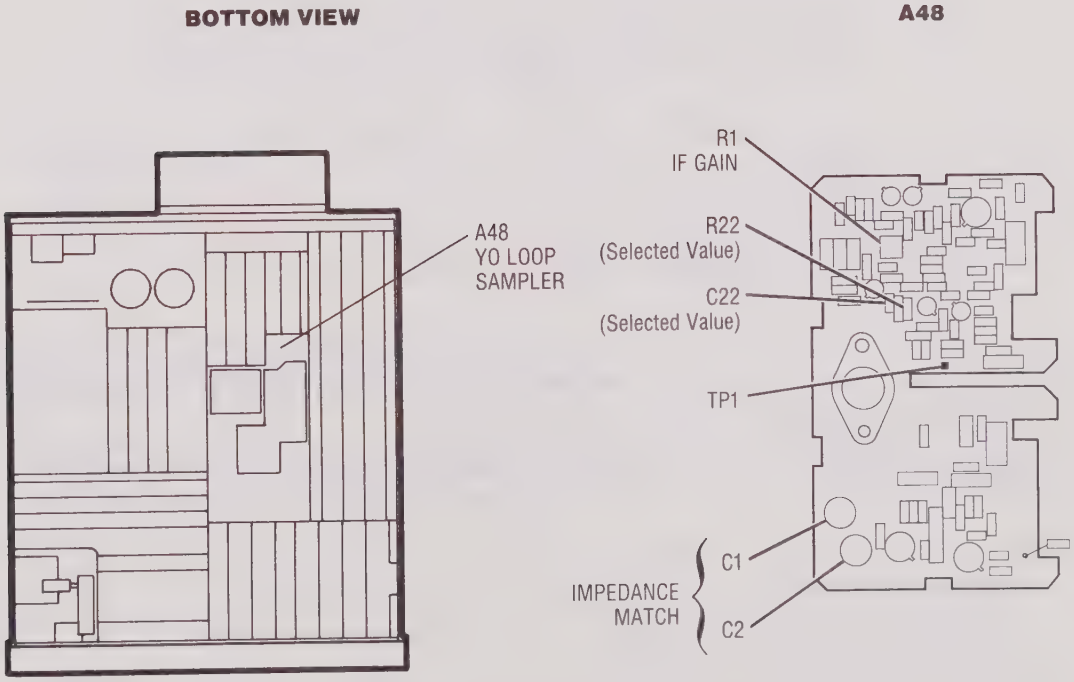


Figure 5-19. Location of YO Loop Adjustments

5-8. YO LOOP ADJUSTMENTS (Cont'd)

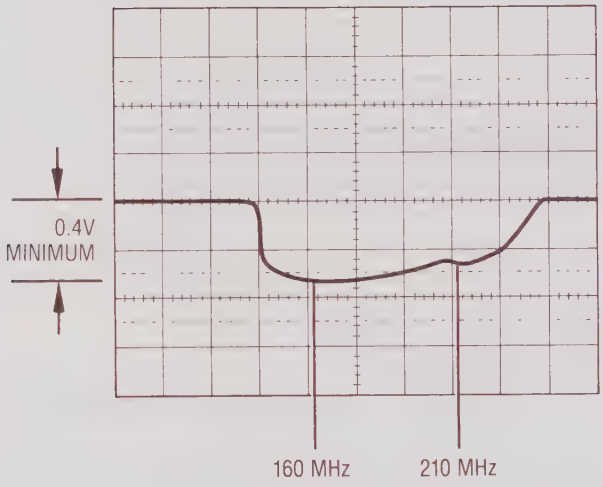


Figure 5-20. Typical Swept Frequency Response at A48TP1

12. Set the Spectrum Analyzer as follows:

    a. Press **[INSTR PRESET]**
    b. Set CENTER FREQ to 30 MHz
    c. Set FREQUENCY SPAN to 60 MHz
    d. Press Marker **[PEAK SERACH]** then **[SIGNAL TRACK]**.
    e. Set REF LEVEL to +10 dBm.

13. On the Sweep Generator press **[CW]** then adjust the rotary knob to set a frequency that will produce a center frequency readout on the Spectrum Analyzer of 25.0 MHz. (See Figure 5-21.) Turn off **[SIGNAL TRACK]** on Spectrum Analyzer.

14. On the DUT, adjust A48R1 (IF GAIN) for a 25 MHz signal displayed on the Spectrum Analyzer of approximately 0 dBm.

15. Set the Spectrum Analyzer as follows:

    a. Press **[INSTR PRESET]**
    b. Set CENTER FREQUENCY to 50 MHz
    c. Set FREQUENCY SPAN to 100 MHz
    d. Set REFERENCE LEVEL to +10 dBm
    e. Select 5 dB/DIV
    f. Select MAX HOLD on Trace A

5-8. YO LOOP ADJUSTMENTS (Cont'd)

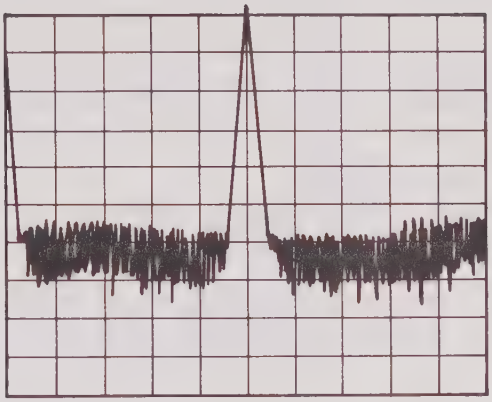


Figure 5-21. YO Loop Gain at A48J1

NOTE

If Sweep Generator frequency is changed too quickly in Step 15, drop outs will occur on the Spectrum Analyzer display. If this happens, slowly adjust the Sweep Generator frequency so that the IF response passes over the drop outs and eliminates them.

16. Slowly tune the Sweep Generator using the rotary knob while monitoring the display on the Spectrum Analyzer. (Maximum hold may be used on the Spectrum Analyzer to trace out the IF response as the frequency is changed.) Verify that the IF frequency response falls within the limits shown in Figure 5-22. If it does not, select new values for A48C22 and A48R22 to adjust the shape of the response (particularly in the 20 to 30 MHz region). Readjust A48R1 IF GAIN control if necessary.

17. Set the DUT's LINE switch to STANDBY. Disconnect all test cables going to the DUT.

18. Remove the jumper between A59TP4 and A59TP5.

19. Reinstall the A48 cover and remove the cover from the A49 YO Phase Detector. Removal of the A49 cover will require disassembly of the YO loop. After the cover is removed, reassemble the YO loop. Ensure that all the SMB cables are connected correctly.

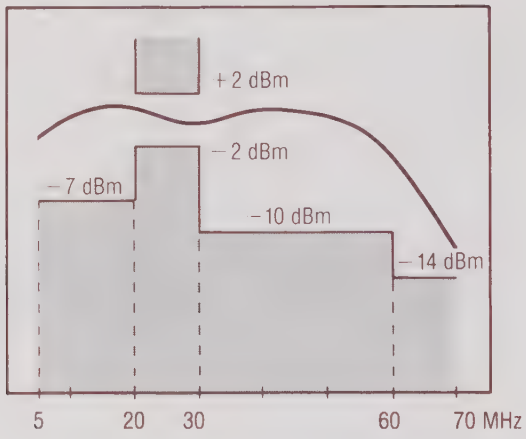


Figure 5-22. IF Frequency Response Limits

GAIN AND PHASE MARGIN ADJUSTMENT

20. Fabricate the special test fixture as shown in Figure 5-23.

21. Place the YO Loop in the Service Position and remove the cover from the A49 Phase Detector board. Remove jumper A49W1 from the Phase Detector board.

22. Connect the Special Test Fixture and the Spectrum Analyzer to the YO Loop as shown in Figure 5-24.

23. On the Special Test Fixture, set S1 to position 1 and set S2 to the J2 position. The YO Loop should now be locked as indicated by A50DS1 (green LED) being lit.

24. On the DUT, press **[INSTR PRESET] [CW] [3] [GHz]**.

25. Set up the Spectrum Analyzer as follows:

INSTR PRESET	Press
TRACKING GENERATOR AMPLITUDE	Fully Clockwise (0 dBm)
INPUT IMPEDANCE	1 Megohm
AUTO RANGE	OFF
REF. LVL. TRK	OFF
START FREQ	0 Hz
STOP FREQ	100 kHz
dB/div	1 dB/div.
REF. LEVEL	−25 dBm
RANGE (use STEP keys)	−15 dBm

26. A trace similar to Figure 5-25, Waveform A should be displayed on the Spectrum Analyzer.

27. On the Spectrum Analyzer, press [STORE A → B] to store the trace from A into Trace B. On the Special Test Fixture, set switch S1 to position 2. The Spectrum Analyzer should display the two traces similar to Figure 5-25, Waveform B.

5-8. YO LOOP ADJUSTMENTS (Cont'd)

28. Using the rotary knob on the Spectrum Analyzer, move the marker to the point where the two traces cross. Observe the marker frequency on the Spectrum Analyzer. The marker (crossover frequency) should be between 30 and 40 kHz.

29. If the crossover frequency is below 30 kHz, the value of A49R18 on the A49 YO Phase Detector board should be decreased in value to increase the crossover frequency. If the crossover frequency is above 40 kHz, the value of A49R18 should be increased to lower the crossover frequency.

30. Disconnect all test equipment from the DUT and reinstall the jumper (W1) on the A49 Phase Detector board.

31. Proceed directly to Adjustment 5-9, FM Accuracy and FM Overmod Adjustment. DO NOT REASSEMBLE THE YO LOOP.

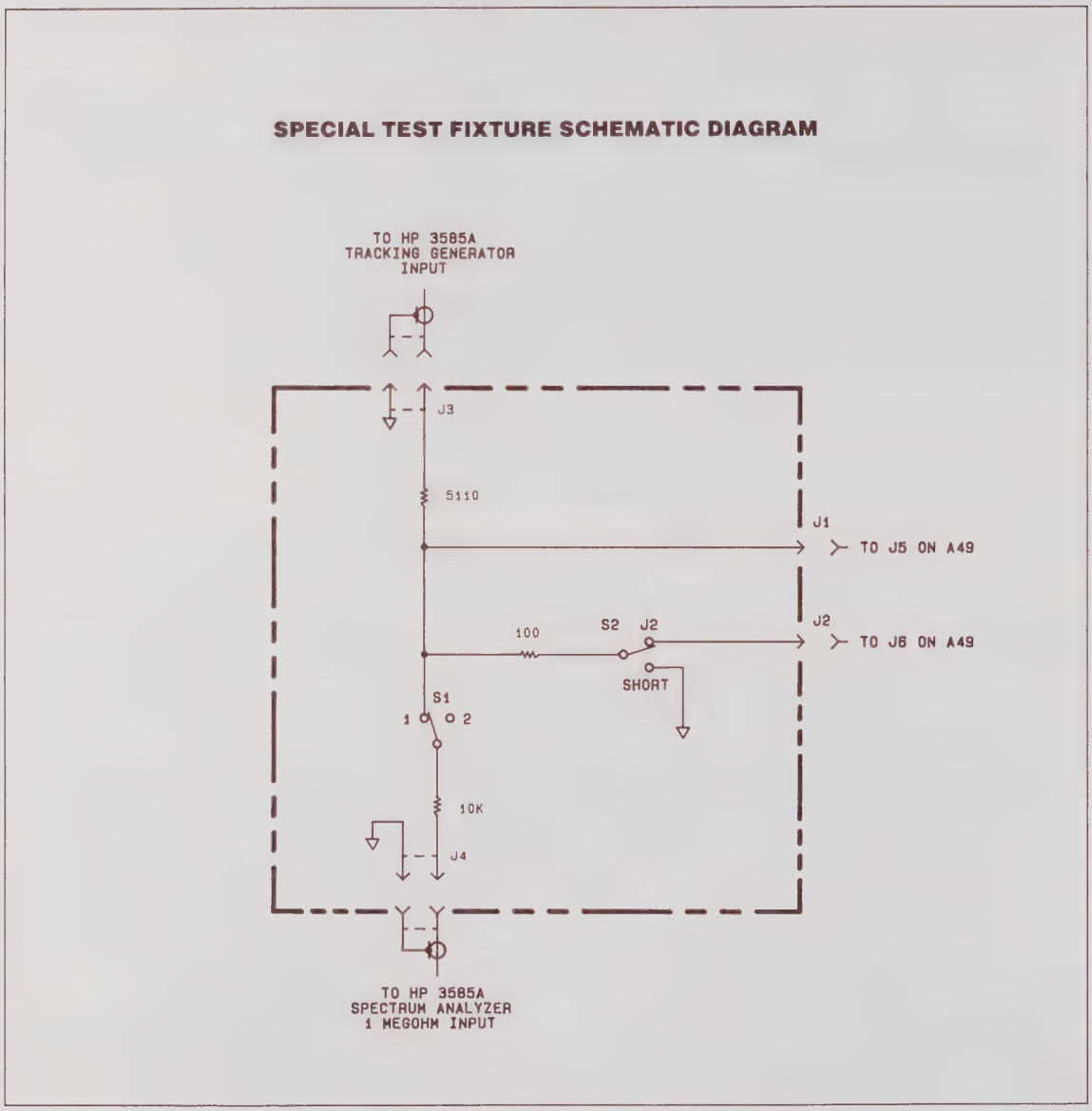
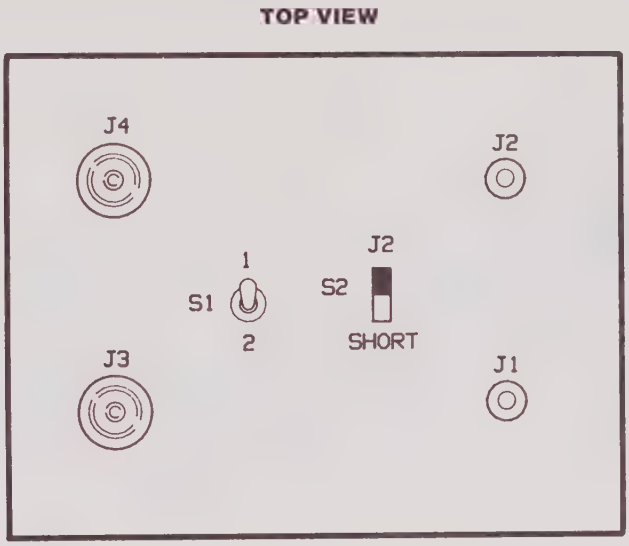
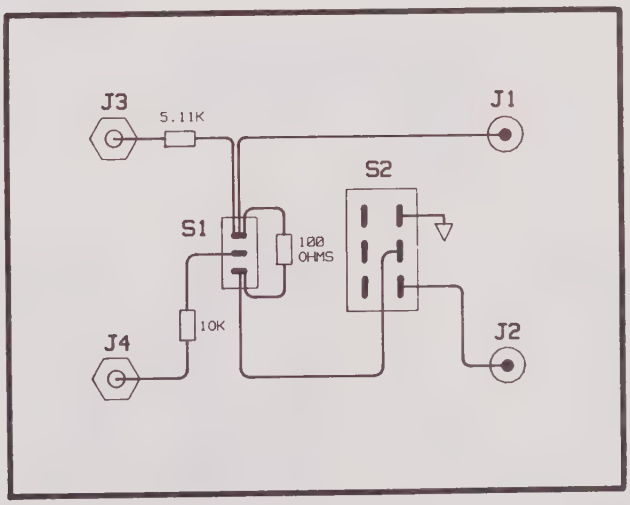


Figure 5-23. Special Test Fixture Fabrication Instructions (1 of 2)





YO Special Test Fixture Material List

Qty	Description	HP Part Number	Qty	Description	HP Part Number
1	BUD BOX 2.75 × 2.1	7100-1207	2	CHASSIS MOUNT SNAP ON (M)	1250-0691
1	SWITCH SPDT (TOGGLE)	3101-0163	2	LOCK WASHER	2190-0124
1	SWITCH DPDT (SLIDE)	3101-0070 (only requires a SPDT)	2	NUT	2950-0078
2	CHASSIS MOUNT BNC (F)	1250-0212	1	10kΩ ¼W RESISTOR	0757-0442
2	LOCK WASHER	2190-0016	1	100Ω ¼W RESISTOR	0757-0401
2	NUT	2950-0001	1	5.11KΩ ¼W RESISTOR	0757-0438

Figure 5-23. Special Test Fixture Fabrication Instructions (2 of 2)

5-8. YO LOOP ADJUSTMENTS (Cont'd)

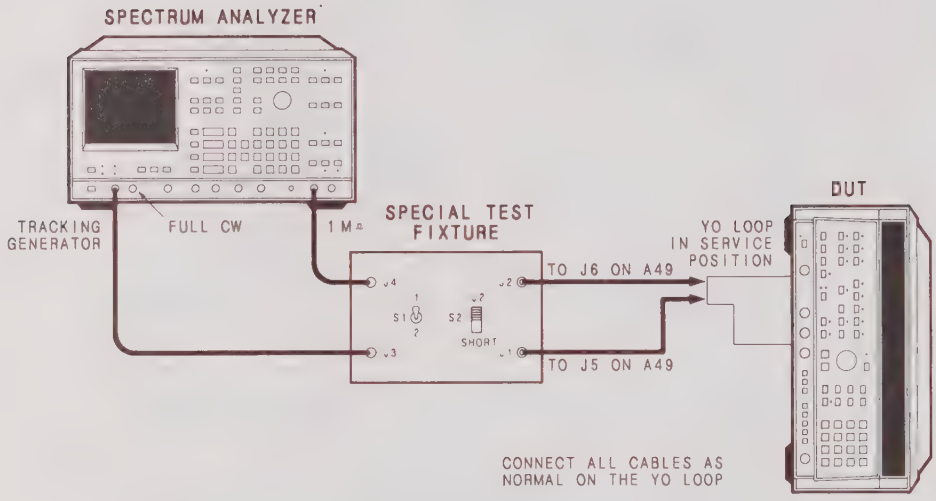


Figure 5-24. YO Loop Gain Test Setup

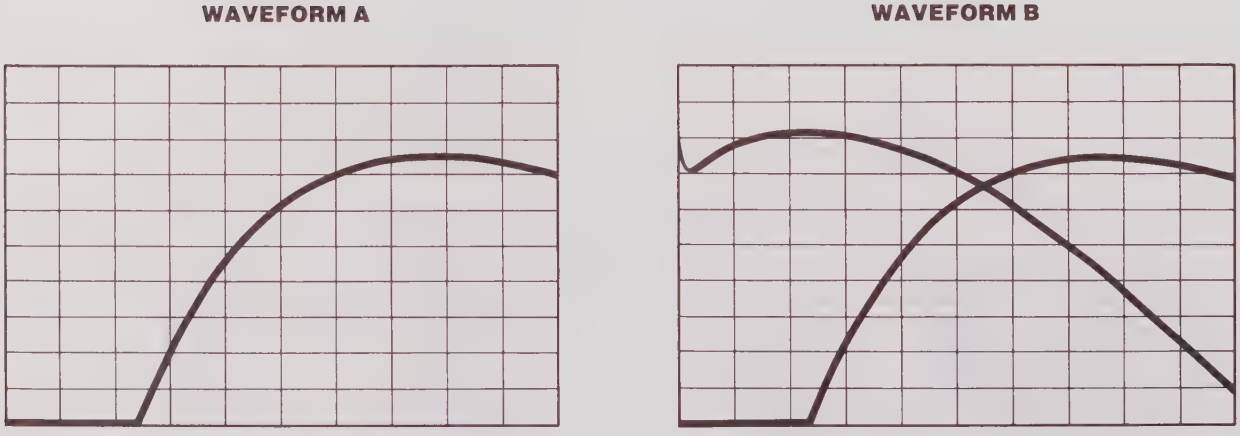


Figure 5-25. Spectrum Analyzer Waveforms of YO Loop Gain

5-9. FM ACCURACY AND FM OVERMOD ADJUSTMENT

Reference

Performance Test: FM
Service Section: Sweep Generator – YO Loop

Description

In the FM accuracy portion of this adjustment procedure, a synthesized function generator and is used to FM the DUT at a fixed modulation rate and frequency deviation. The FM input signal is set such that when the DUT's FM GAIN adjustment (FM accuracy) is adjusted properly, the power of the DUT's carrier frequency will be nulled (minimum power level).

In the FM overmodulation adjustment portion of this adjustment, the DUT is initially set up for its maximum frequency deviation and modulation rate. From this point, the rate is increased until the DUT's FM circuitry reaches its maximum capability. The modulation rate is then decreased until the circuitry stabilizes and the overmod adjustment is set to just turn on the OVERMOD annunciator.

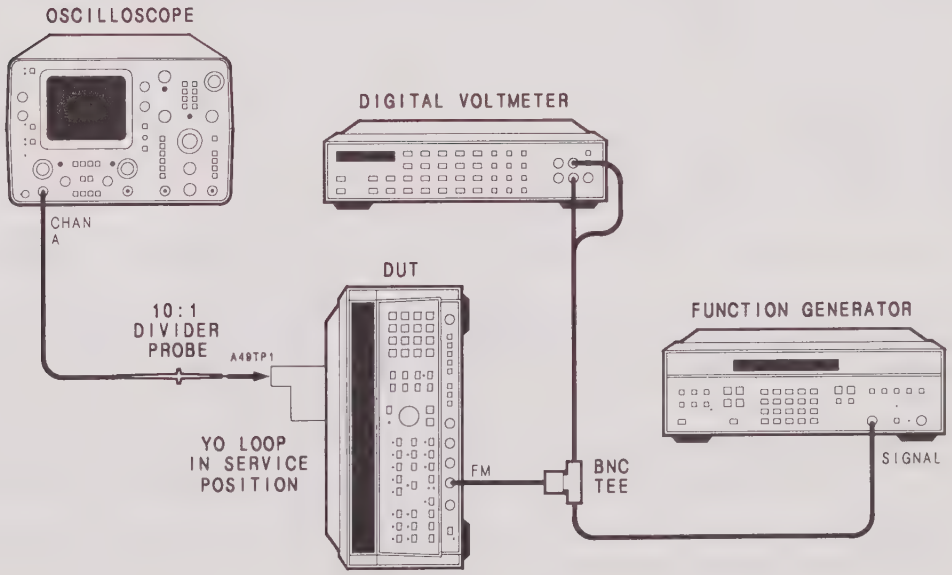


Figure 5-26. FM Accuracy and Overmod Adjustment Setup

5-9. FM ACCURACY AND FM OVERMOD ADJUSTMENT (Cont'd)

Equipment

Spectrum Analyzer	HP 8566B
Digital Voltmeter	HP 3456A
Function Generator	HP 3325A
Oscilloscope	HP 1741A
Adapters:	
APC 3.5(f) to TYPE N(m) (2 required)	HP P/N 1250-1744
APC 3.5 (f) APC 3.5 (f) (8340B only)	HP P/N 5061-5311
BNC(f) to dual banana	HP P/N 1251-2277
BNC Tee	HP P/N 1250-0781
Cables:	
Semi-Rigid, SMA (m) to SMA (m)	HP P/N 08340-20124
BNC (m) to BNC (m) (2 required)	HP P/N 8120-1840

FM GAIN ADJUSTMENT

1. Connect the equipment as shown in Figure 5-26, FM Accuracy and Overmod Adjustment Setup. The BNC Tee should be connected directly to the DUT's FM input BNC. Switch the DUT to ON and allow the equipment to warm up for 30 minutes.

2. On the DUT, press

   [INSTR PRESET]
   [CW] [1] [0] [GHz]
   [POWER LEVEL] [0] [dBm]
   [FM]

   Use the **DOWN ARROW** step key to select an FM sensitivity of 1 MHz/V (default condition).

3. Set the DVM to measure ac volts. Set up the function generator for a 100 kHz sine wave. Adjust the function generator's amplitude for 0.16996 Vrms (measured on the DVM). You may not be able to set the function generator's amplitude for this exact voltage so adjust the voltage as close as possible.

4. Press **[FM]** on the DUT to turn FM off. Adjust the spectrum analyzer to center the DUT's 10 GHz output (carrier frequency) on the center of the display. Select a frequency span of 500 kHz.

5. Press **[FM]** on the DUT to turn FM on. Adjust A23R28 FM GAIN to null the carrier (i.e., reduce the carrier's power level as much as possible).

FM OVERMOD ADJUSTMENT

6. If the YO Loop is already disassembled, proceed to step 7.

   Remove the YO Loop from the DUT and remove the cover from the A49 YO Phase Detector assembly. In order to remove the cover on the A49 assembly, the YO Loop will need to be disassembled. Reinstall the YO Loop and place it in the service position. Reinstall the ribbon cable and SMB cables which were removed during disassembly.

5-9. FM ACCURACY AND FM OVERMOD ADJUSTMENT (Cont'd)

7. On the DUT, press **[CW] [4] [.] [5] [GHz]**. Press **[FM]** to turn the FM on and use the **UP ARROW** step key to select 10 MHz/V FM sensitivity.

8. Set the function generator for a 1.5 MHz sine wave and adjust the amplitude for a 0.707 Vrms reading on the DVM.

9. Connect the oscilloscope's Channel A input to A49TP1. Set the oscilloscope for 0.01 V/div, ac coupled, and 0.5 us/div. The oscilloscope display should look similar to Figure 5-27.

10. Adjust A49R3 until the OVERMOD annunciator on the DUT's front panel turns on, then adjust A49R3 until the OVERMOD annunciator just turns off.

11. Disconnect all of the test equipment from the DUT. Reinstall the cover onto the A49 Phase Detector assembly and reinstall the YO Loop into the DUT.

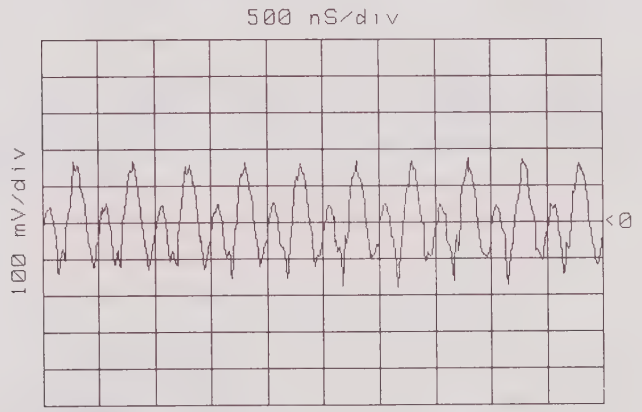


Figure 5-27. Typical Waveform at A49TP1

5-10. YO DELAY COMPENSATION, A54

Reference

Performance Test: Swept Frequency Accuracy
Service Section: Sweep Generator - YO Loop

Description

In this procedure, the programmable width of the YO kick pulse is calibrated. Then the YO delay is adjusted so the marker position tracks from the slowest to the fastest sweep speeds.

Equipment

Spectrum Analyzer	HP 8566B
Oscilloscope	HP 1741A
Adapter, APC-3.5 (f) to Type N (m), (2 required for HP 8341B, one for HP 8340B)	HP P/N 1250-1744
Cable, SMA (m) to SMA (m)	HP P/N 08340-20124
Adapter, APC 3.5 (f) to APC 3.5 (f) (required for HP 8340B)	HP P/N 5061-5311

NOTE

In the test setup, 2 APC 3.5 (f) to Type N (m) adapters are used with an SMA semi-rigid cable. This setup is used, instead of connecting the DUT to the spectrum analyzer with a Type N cable, to reduce power loss through the cable.

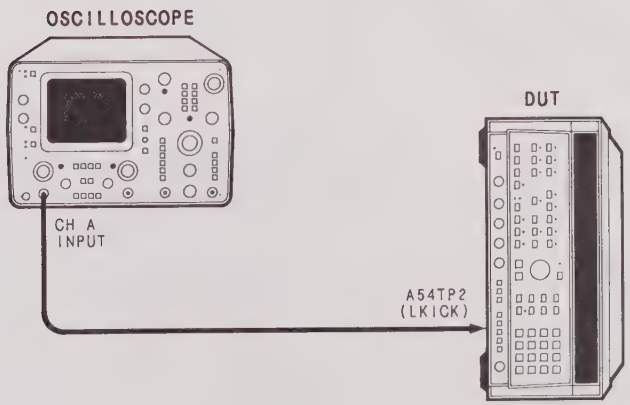


Figure 5-28. YO Kick Pulse Test Setup

5-10. YO DELAY COMPENSATION, A54 (Cont'd)

Procedure

1. Position the DUT in the Test Position as shown in Figure 5-28 with bottom cover removed. Turn the LINE switch on. Connect equipment as shown in Figure 5-28 and allow one-half hour warm-up time.

YO KICK PULSE ADJUSTMENT

2. On the DUT, make the following settings:

   a. Press **[INSTR PRESET]**
   b. Press **[START FREQ]** then enter **[2] [.] [3] [GHz]**
   c. Press **[STOP FREQ]** then enter **[6] [.] [9] [9] [GHz]**.

3. Adjust A54R36 (PW, Figure 5-30) for a 12.5 msec pulse on the oscilloscope.

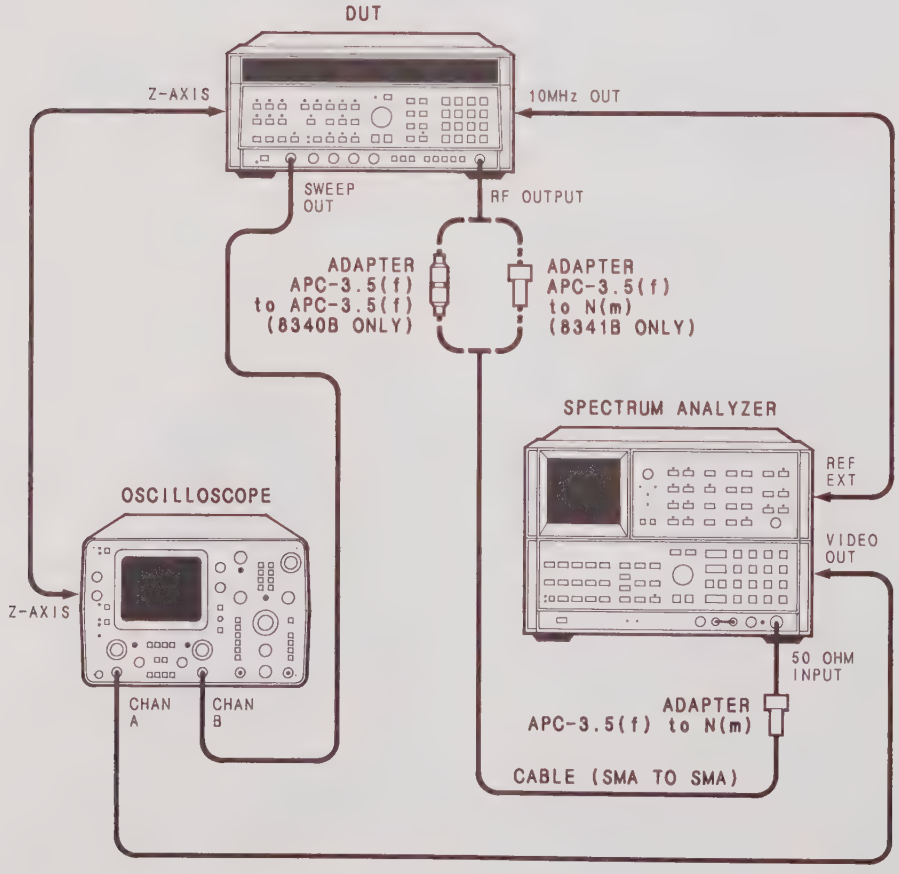


Figure 5-29. YO Delay Compensation Test Setup

5-10. YO DELAY COMPENSATION, A54 (Cont'd)

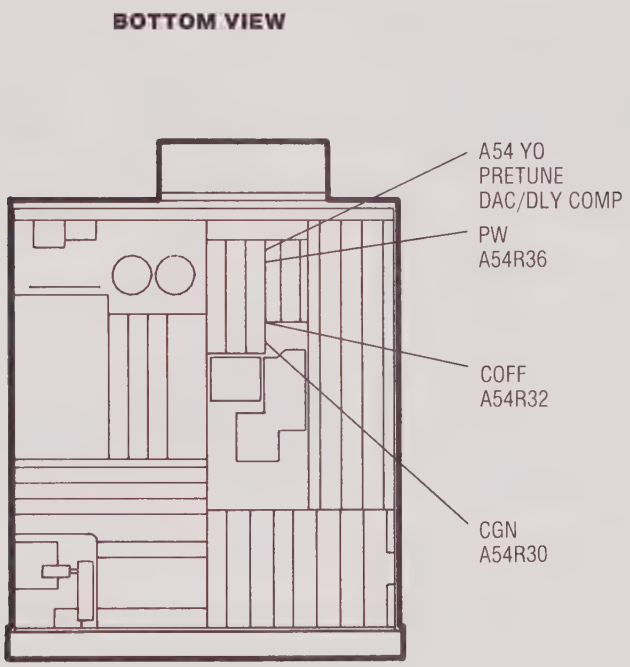


Figure 5-30. YO Delay Compensation Adjustments Location

YO DELAY ADJUSTMENT

4. Connect the test equipment as shown in Figure 5-29.

5. Set the DUT as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[START FREQ]** then enter **[6] [.] [9] [GHz]**
   c. Press **[STOP FREQ]** then enter **[1] [3] [.] [5] [GHz]**
   d. Press **[M1]** then enter **[7] [.] [2] [GHz]**
   e. Press **[AMTD MKR]** on.
   f. Press **[SAVE]** then enter **[2]**
   g. Press **[SWEEP TIME]** then enter **[2] [0] [0] [msec]**
   h. Press **[SAVE]** then enter **[1]**
   i. Press Frequency Marker **[OFF]**
   j. Press **[M2]** then enter **[1] [3] [.] [2] [GHz]**
   k. Press **[SAVE]** then enter **[3]**
   l. At ENTRY pad, press **[AUTO]** (sweep time)
   m. Press **[SAVE]** then enter **[4]**
   n. Press **[RECALL]** then enter **[1]**

5-10. YO DELAY COMPENSATION, A54 (Cont'd)

6. Set the Spectrum Analyzer as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[CENTER FREQUENCY]** then enter 7.2 GHz
   c. Press **[FREQUENCY SPAN]** then enter 0 Hz
   d. Press **[SINGLE]** Sweep

7. Set the Oscilloscope as follows:

   a. Select A vs. B Mode
   b. Set Channel A Volts/Division to 0.5 V/DIV
   c. Set Channel B Volts/Division to 0.1 V/DIV

8. Press **[RF]** on the DUT to turn RF power off.

9. On the oscilloscope, position the marker to center screen with horizontal position control. Press oscilloscope MAG × 10. Reposition the beginning of the marker at center line of screen with the horizontal position control. (See Figure 5-31.)

10. Press **[RF]** on the DUT to turn RF power on.

11. Press the Spectrum Analyzer CENTER FREQUENCY key then use the rotary knob to set Center Frequency so the peak of the signal is at the center line of the oscilloscope screen. (See Figure 5-32.)

12. On the DUT, press **[RECALL]** then enter **[2]**. Press **[RF]** to turn RF power off.

13. Adjust the oscilloscope horizontal position to place the beginning of the marker at the center line of the screen.

14. On the DUT, press **[RF]** key to turn RF power on. Adjust A54R32 (COFF) to set the peak of the signal at the center of the oscilloscope screen.

15. On the DUT, press **[RECALL]** then enter **[3]**.

16. On the Spectrum Analyzer, press CENTER FREQUENCY then enter 13.2 GHz.

17. Set the oscilloscope Channel B Volts/Division switch to 2 V/DIV.

18. On the DUT, press **[RF]** to turn RF power off.

19. Adjust the oscilloscope horizontal position control so the beginning of the marker is at the center line of the screen.

20. On the DUT, press **[RF]** to turn RF power on.

21. Press the Spectrum Analyzer CENTER FREQUENCY and adjust frequency using rotary knob so the peak of the signal is at the center line of the oscilloscope screen.

22. On the DUT, press **[RECALL]**, then enter **[4]**. Press **[RF]** to turn RF power off.

23. Adjust the oscilloscope horizontal position to place beginning of the marker at the center line of the screen.

5-10. YO DELAY COMPENSATION, A54 (Cont'd)

24. Press the DUT's **[RF]** key to turn RF power on. Adjust A54R30 CGN to set the peak of the signal at the center line of the oscilloscope screen.

25. On the DUT, press **[RECALL]**, then enter **[1]**. Repeat steps 7 through 24 until no further adjustment of A54R30 (CGN) and A54R32 (COFF) is necessary.

26. Disconnect all of the test equipment and reconnect the cables.

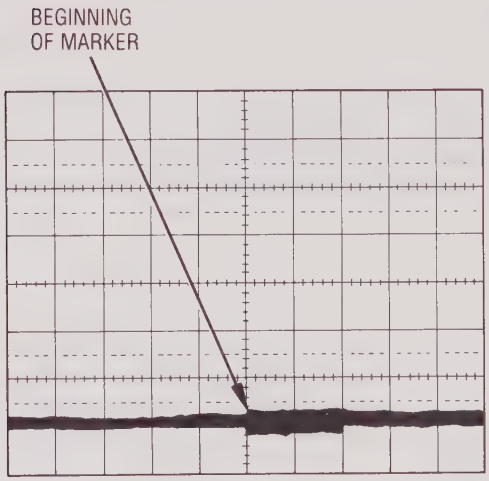


Figure 5-31. Z-Axis Marker Waveform

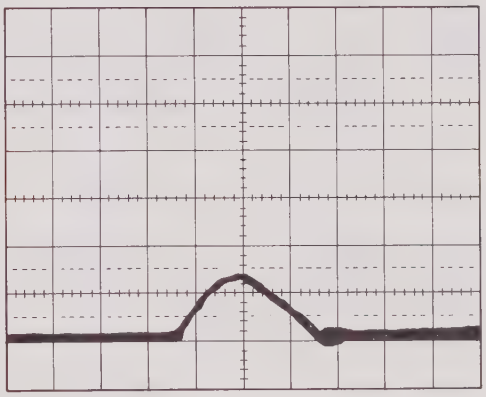


Figure 5-32. Amplitude Marker Waveform

5-11. 3.7 GHz OSCILLATOR, A8

NOTE

This procedure is provided primarily for those cases when the A8A1 circuit board has been repaired or replaced.

Reference

Performance Test: None
Service Section RF Section (Power Level Control)

Description

This procedure monitors the output current of the 100 MHz RF Amplifier that provides the LO signal for the sampler and adjusts for maximum output. The oscillator phase-lock loop is then opened by removing jumper A8E3 and the balance is adjusted at the output of the sampler to obtain a symetrical square wave of approximately 35 Volts peak-to-peak to drive the phase-lock amplifier.

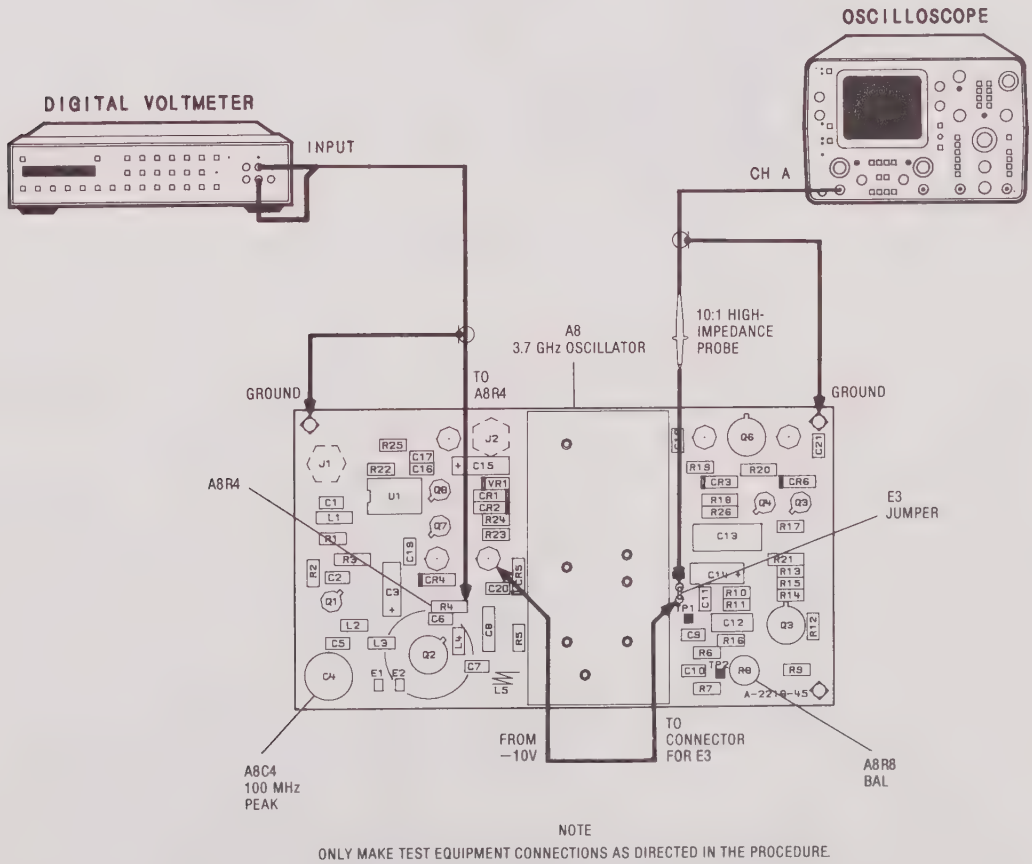


Figure 5-33. A8 3.7 GHz Oscillator Test Setup

5-11. 3.7 GHz OSCILLATOR, A8 (Cont'd)

Equipment

Digital Voltmeter	HP 3456A
Oscilloscope	HP 1741A
10:1 Divider Probe	HP 10004D

Procedure

1. Connect the DVM to A8R4 as shown in Figure 5-33.
2. Adjust A8C4 (100 MHz Peak) for minimum indication on the DVM. (This is maximum current through A8R4 and A8Q2.)
3. Turn the DUT to standby and remove the DVM connections from A8R4.
4. Remove the Jumper A8E3. Connect a jumper from the −10 volt terminal to the lower connection point for E3 as shown in Figure 5-33. (This applies −10 volts to the oscillator.)
5. Connect the Oscilloscope 10:1 high-impedance probe to the upper connection point for E3 as shown in Figure 5-33. Switch the DUT on.
6. Adjust A8R8 (BAL) for a 50% duty cycle square wave with approximately 35 Volts peak-to-peak.
7. Turn the DUT to standby, remove the −10 Volt jumper, oscilloscope probe connections, and reinstall A8E3 in its original position.

5-12. MARKER/BANDCROSS, A57

Reference

Performance Test: None
Service Section: Controller

Description

This procedure adjusts the manual sweep for a range of 0 to 10 Volts and sets the end of sweep at 10 Volts.

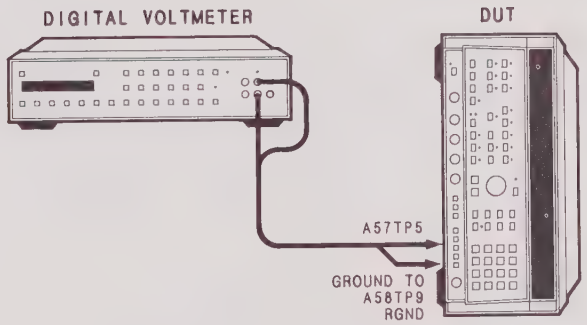


Figure 5-34. Marker Band Crossing Test Setup

Equipment

Digital Voltmeter	HP 3456A

Procedure

MANUAL SWEEP GAIN

1. Place the DUT in the test position and connect the test equipment as shown in Figure 5-34. Allow one-half hour for warmup.

2. Set the DUT as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[START]** then enter **[4] [GHz]**
   c. Press **[STOP]** then enter **[5] [GHz]**
   d. Press **[MANUAL]** Sweep.
   e. Press **[SHIFT] [GHz] [1] [3] [Hz]**, **[SHIFT] [MHz] [2] [Hz]**, and **[SHIFT] [kHz] [1] [0] [0] [0] [Hz]**. (This writes decimal 1,000 to IO address 13, R2.)

3. Adjust A57R33 (MAN GAIN, Figure 5-35) for 10.0000 ± 0.0005 Vdc at A57TP5 as indicated on the DVM.

5-12. MARKER/BANDCROSS, A57 (Cont'd)

END OF SWEEP ADJUSTMENT

4. Set the DUT as follows:

   a. Press **[INSTR PRESET]**
   b. Press **[START FREQ]** then enter **[4] [GHz]**
   c. Press **[STOP FREQ]** then enter **[5] [GHz]**
   d. Press **[SHIFT] [MHz] [2] [3] [Hz] [SHIFT] [kHz] [0] [Hz]** to stop the sweep at the end of band (5 GHz).

5. Connect the DVM to A57TP5 (SWEEP OUT), and DVM's ground lead to A58TP9 (RGND).

6. Adjust A57R32 (EOS, Figure 5-35) for an indication on the DVM of 10.000 ±0.0008 Vdc.

7. Press **[CONT]** Sweep key after each adjustment is made for an update of end of sweep indication.

8. Repeat steps 6 and 7 until no further adjustment is needed.

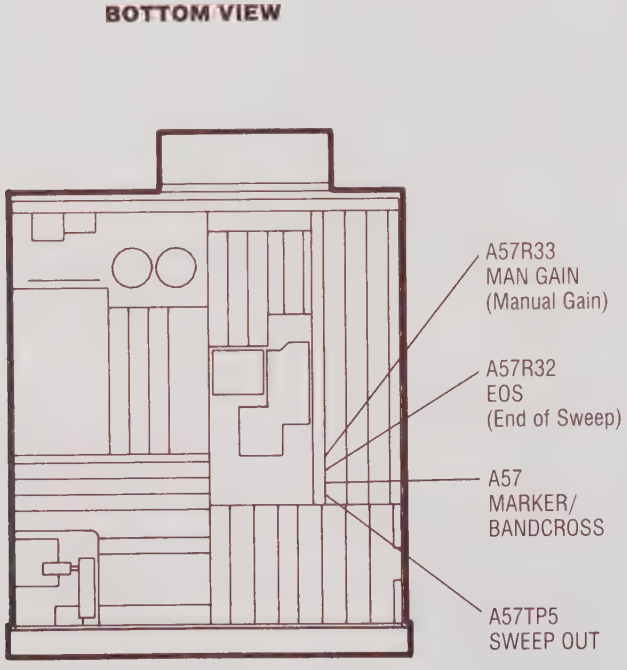


Figure 5-35. Marker Band Crossing Adjustments Location

5-13. SWEEP GENERATOR, A58

Reference

Performance Test: Swept Frequency Accuracy
Service Section: Sweep Generator - YO Loop

Description

The first section adjusts the gain of the sweep ramp amplifier. The next section adjusts the reset error. The last section adjusts the relationship between the VSWP ramp signal and the marker ramp.

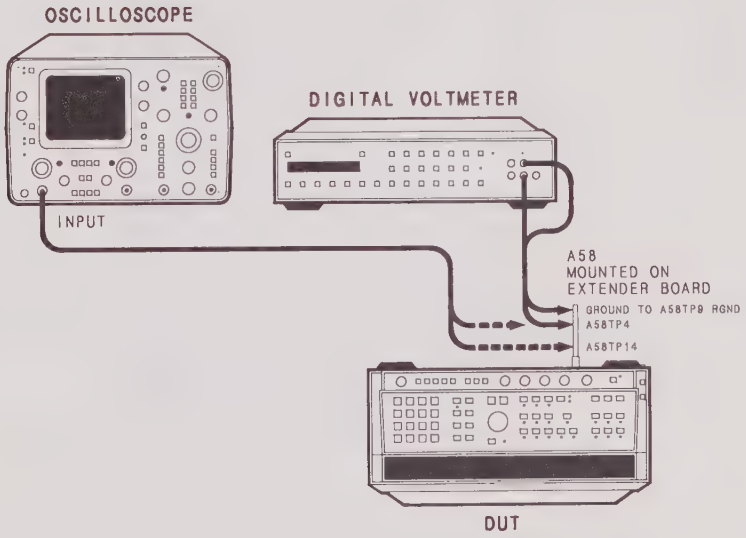


Figure 5-36. Sweep Generator Test Setup

Equipment

Oscilloscope	HP 1741A
Digital Voltmeter (DVM)	HP 3456A

Procedure

1. Place the DUT in the test position as shown in Figure 5-36 with bottom cover removed and the A58 Sweep Generator assembly on an extender board. Connect the oscilloscope to A58TP4 (MKR RMP). Turn the DUT's LINE switch ON and allow one-half hour warm up time.

SWEEP RAMP GAIN ADJUSTMENT

2. On the DUT press **[INSTR PRESET]**, **[START FREQ]** and enter **[2] [.] [3] [GHz]**.
3. Press **[STOP FREQ]** then enter **[7] [GHz]**.
4. Press **[SWEEP TIME]** then enter **[1] [0] [msec]**.
5. Adjust A58R4 (SWP TIME, Figure 5-37) for a 10 ms ramp on the oscilloscope (Figure 5-38).

5-13. SWEEP GENERATOR, A58 (Cont'd)

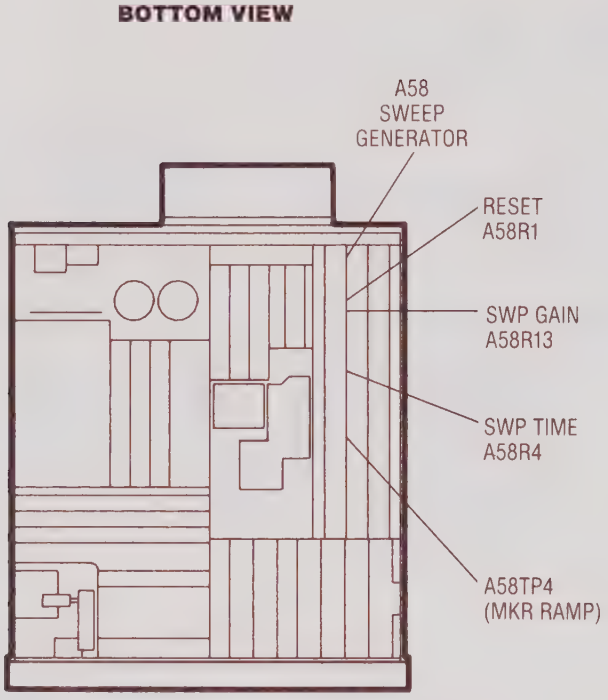


Figure 5-37. Sweep Generator Adjustments Location

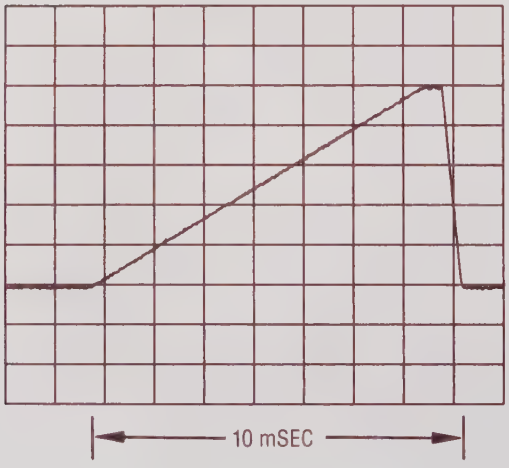


Figure 5-38. Sweep Ramp at A58TP4

5-13. SWEEP GENERATOR, A58 (Cont'd)

RESET ERROR ADJUSTMENT

6. Connect the oscilloscope to A58TP14 (ERROR).

7. Press **[INSTR PRESET]** on the DUT.

8. Adjust A58R1 (RESET, Figure 5-37) for as close as possible to zero Volt average on the oscilloscope. (See Figure 5-39.)

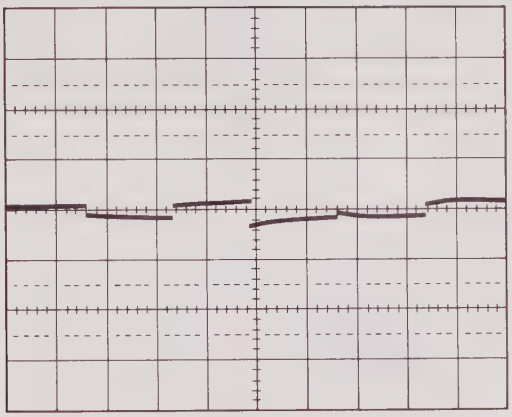


Figure 5-39. Reset Pulse Adjusted to Zero Volt Average

SWEEP GAIN ADJUSTMENT

9. Connect the DVM to A58TP4 (MKR RMP) and connect the DVM ground to A58TP9 (RGND).

10. Set the DUT controls as follows:

    a. Press **[INSTR PRESET]**
    b. Press **[START FREQ]** then enter **[2] [.] [3] [GHz]**
    c. Press **[STOP FREQ]** then enter **[7] [GHz]**
    d. Press **[SHIFT] [MHz] [2] [3] [Hz] [SHIFT] [kHz] [0] [Hz]** to stop the sweep at the end of sweep (7 GHz).

11. Record the reading at on the DVM.

12. Connect the DVM to A58TP10 (VSWP).

13. Adjust A58R13 (SWP GAIN) control so that the DVM reading at A58TP10 = 94% of reading at A58TP4 taken in step 11. EXAMPLE:

    a. DVM reading in step 11 at A58TP4 = 9.9884 Volts
    b. (0.94) (9.9884V) = 9.38909 Volts
    c. Adjust A58R13 for DVM reading at A58TP10 of 9.38909 Volts.

14. Turn the DUT's LINE switch to STANDBY. Remove the extender board from the A58 assembly and re-install A58.

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS

Reference

Performance Test: Maximum Leveled Output Power and Accuracy
Service Section: RF Section

Description

The A28 SYTM Driver assembly is adjusted to cause the SYTM frequency response to track the YO frequency. When the YO frequency is in the center of the SYTM passband, the power loss through the SYTM is minimum; therefore, SYTM tracking is adjusted while viewing power out versus frequency and adjusting the SYTM for maximum power out. In the multiplying bands, Bands 2, 3, and 4, optimum biasing of the step recovery diode (SRD, internal to the SYTM) is also required for maximum power out. Since this the case, the SRD bias adjustments on the A24 and A26 assemblies are also performed in this procedure.

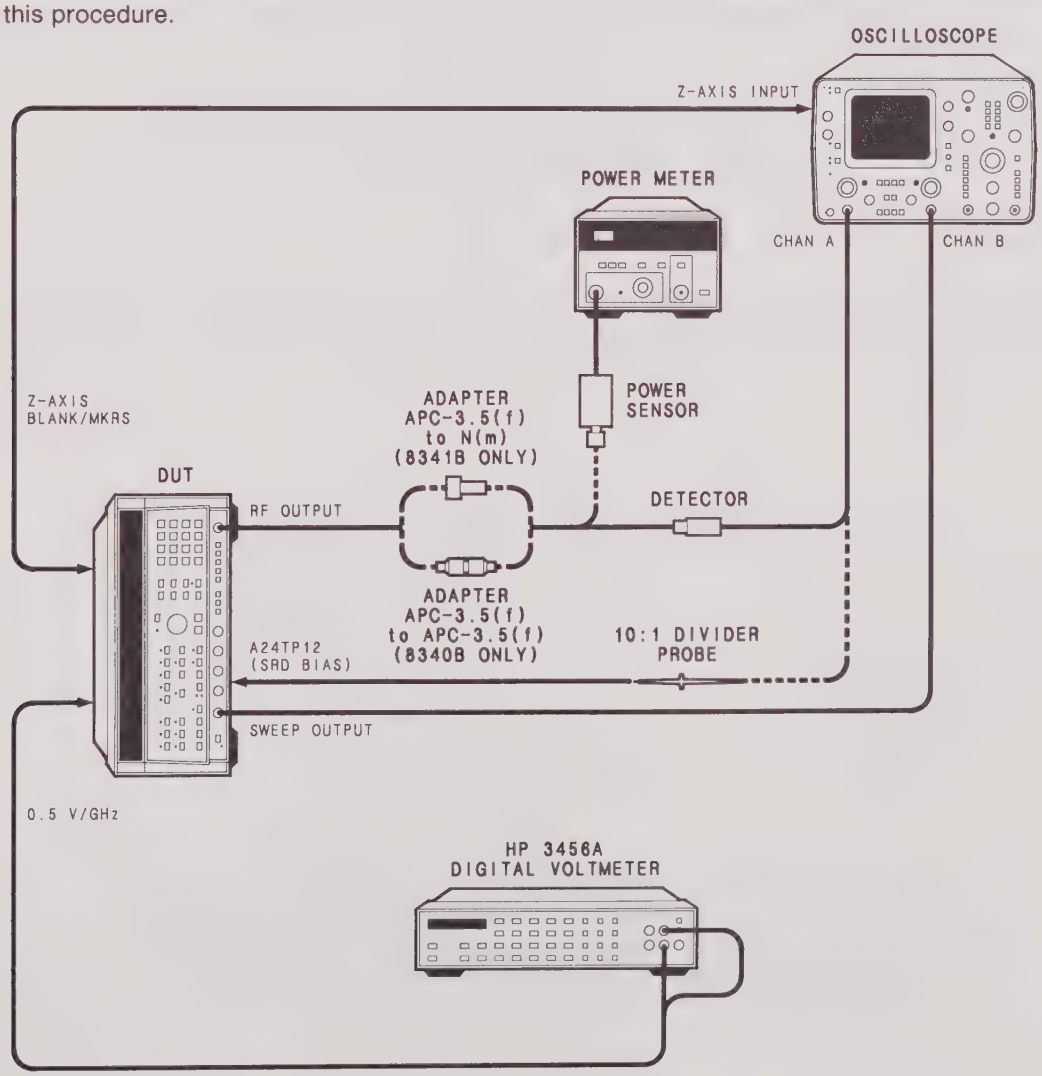


Figure 5-40. Unleveled RF Output Adjustments Setup

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

Equipment

Oscilloscope	HP 1741A
10:1 Divider Probe	HP 10004D
Digital Voltmeter (DVM)	HP 3456A
Power Meter	HP 436A
Power Sensor	HP 8485A
Detector	HP 8473C
Adapters:	
APC 3.5 (f) to APC 3.5 (f) (required if DUT is an HP 8340B)	HP P/N 5061-5311
APC 3.5 (f) — Type N (m) (required if DUT is an HP 8341B)	HP P/N 1250-1744
Dual Banana to BNC (f)	HP P/N 1251-2277

NOTE

The following adjustments should be checked or adjusted before making the adjustments in this procedure: Power Supplies, 20/30 Loop, M/N Loop, Pretune, and Sweep Time.

Procedure

1. Place the DUT in the test position and connect the oscilloscope and detector as shown in Figure 5-40. Connect the DVM to the DUT's rear panel 0.5 V/GHz output BNC. Switch the DUT's LINE switch ON and allow the equipment to warm up for one half hour.

INITIAL SETTINGS

NOTE

Once these initial settings have been made, it will be necessary to complete this procedure and the Leveled RF Output adjustments

2. Access the DUT's Calibration Constants by pressing the following key sequence:

   [INSTR PRESET]
   [SHIFT] [GHz] [2] [Hz]
   [SHIFT] [MHz] [1] [2] [Hz]
   [SHIFT] [kHz] [2] [2] [Hz]

   Preset Cal Constant number 2 to 100 by entering **[1] [0] [0] [Hz].**

NOTE

After initially accessing the Cal Constants, subsequent entry into the Cal Constant mode may be accomplished by pressing; [SHIFT] [GHz] [desired Cal Constant] [Hz] [SHIFT] [ENTRY OFF]. However, after pressing [INSTR PRESET], the full Cal Constant key sequence must be entered (see above).

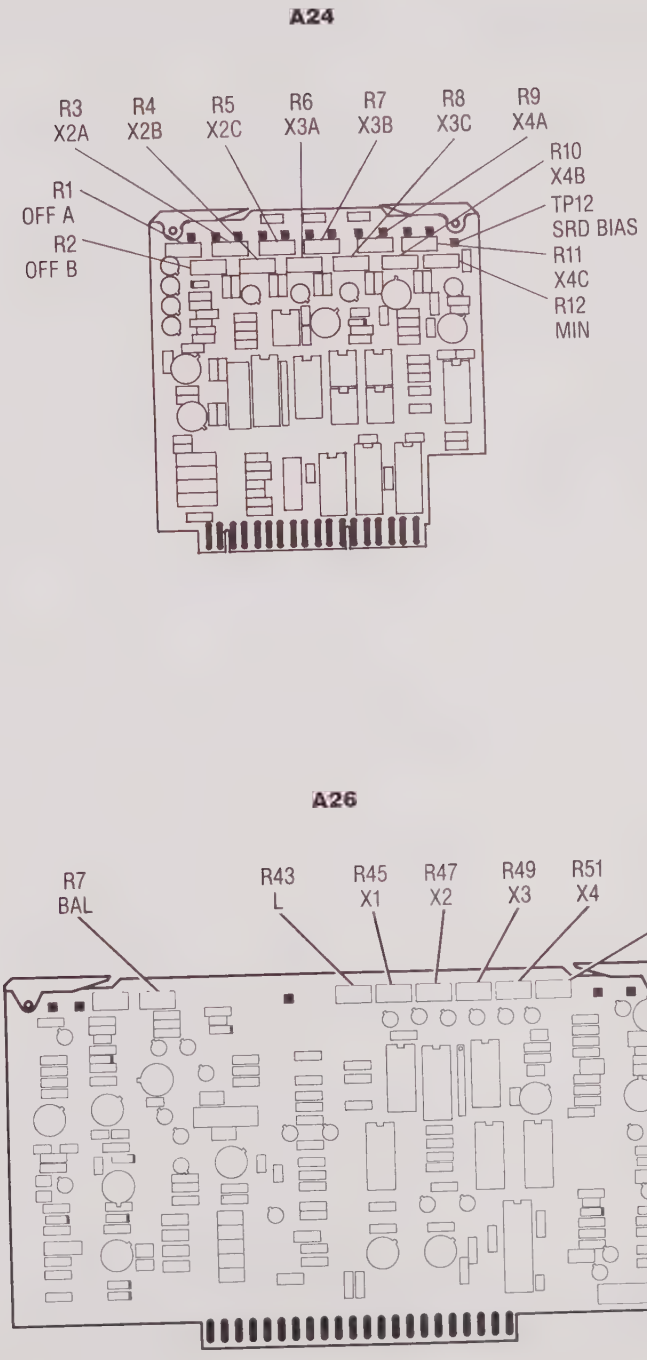


Figure 5-41. Unleveled RF Output Adjustments Location (1 of 2)

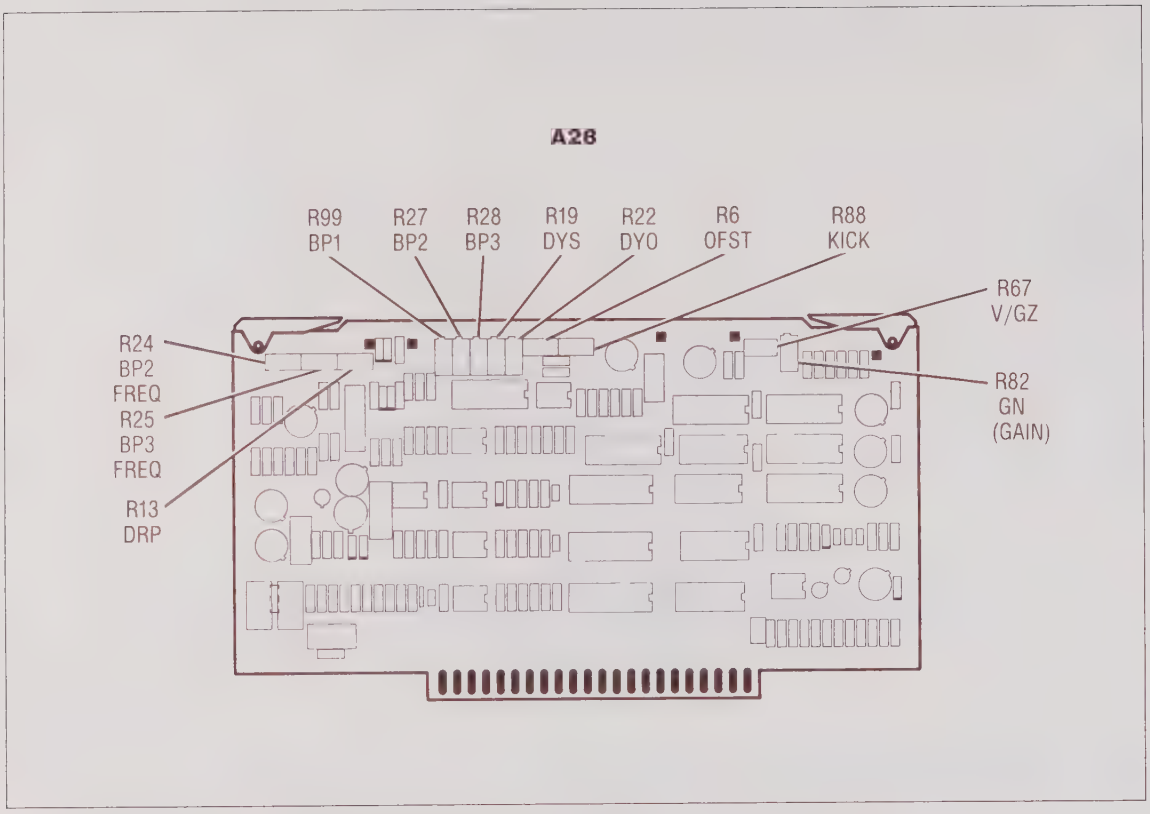


Figure 5-41. Unleveled RF Output Adjustments Location (2 of 2)

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

3. Press the [▲] step key to access each Cal Constant listed in the table below and preset the Cal Constants to the value provided in the table. Be sure to terminate each entry by pressing **[Hz]**.

Cal Constant	Value	Cal Constant	Value
3	100	52	0
4	100	53	0
5	100	71	1024
6	100	72	1024
7	100	73	1024
8	100	74	1024
9	1024	75	25
10	1024	76	1000
11	1024	77	−25
12	1024	78	25
50	0	80	0
51	0		

4. If the A13 SYTM or the A24 Attenuator Driver/SRD Bias assembly has been replaced, preset the following potentiometers (pots) to the position stated (see Figure 5-41):

   Center the following:

   A24R3 (X2A) A24R6 (X3A) A24R9 X4A) A24R12 (MIN)

   A24R4 (X2B) A24R7 (X3B) A24R10 (X4B)

   Set the following fully counter-clockwise:

   A24R1 (OFF A) A24R2 (OFF B) A24R5 (X2C)

   A24R8 (X3C) A24R11 (X4C)

5. If the A13 SYTM or the A28 SYTM Driver assembly has been replaced, preset the following pots to the position stated (see Figure 5-41):

   Center:

   A28R6 (OFST)

   Set the following fully clockwise:

   A28R13 (DRP) A28R24 (BP2 FREQ) A28R25 (BP3 FREQ) A28R88 (KICK)

   Set the following fully counter-clockwise:

   A28R19 (DYS) A28R22 (DYO) A28R27 (BP2)

   A28R28 (BP3) A28R82 (GAIN) A28R99 (BP1)

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

Remove jumpers A28W1 and A28W2 if they are installed on the A28 assembly. These jumpers must be removed to set the V/GHz circuit to 0.5V/GHz.

6. If the A26 assembly has been replaced, preset the following pots to the position stated (see Figure 5-41):

   Set the following fully clockwise:

   A26R88 (MO)

   Center the following:

A26R7 (BAL)	A26R43 (HET)	A26R45 (X1)	A26R47 (X2)
A26R49 (X3)	A26R51 (X4)	A26R91 (GAIN)	

0.5 V/GHZ ADJUSTMENT

7. On the DUT, press **[CW] [1] [0] [MHz].** Adjust A28R67 (V/GHz) for a DVM indication of 5 mV + 0.5 mV.

SYTM TRACKING AND UNLEVELED SRD BIAS ADJUSTMENTS

8. On the DUT, press the following key sequence:

   [START FREQ] [6] [.] [9] [GHz]
   [STOP FREQ] [1] [3] [.] [5] [GHz]
   [POWER LEVEL] [0] [dBm]
   [SWEEPTIME] [2] [0] [0] [msec]
   [XTAL]
   [SAVE] [1]

9. Connect the oscilloscope and detector as shown in Figure 5-40. Set the oscilloscope to A vs B mode, horizontal sensitivity (CHAN B) to 1 V/Div dc, and vertical sensitivity (CHAN A) to 0.05 V/Div dc. Adjust the horizontal and vertical position controls to view the entire swept RF output response on the oscilloscope. Readjust the vertical sensitivity if necessary so that the trace covers the maximum number of divisions possible.

Band 2 Adjustments

10. Adjust A28R82 (GAIN) to peak the power across the entire band (readjust the scope's vertical position and/or sensitivity if necessary).

NOTE

In the following adjustments, turning the X2A/B, X3A/B, or X4A/B controls clockwise when in the appropriate band will increase the SRD bias and be closer to the squegging region[1]. If squegging occurs, turn the above controls counter-clockwise until the RF output power is reduced ≅ 0.5 dB below the squegging region.

---

1. The squegging region is an area where undesired oscillations of the YIG sphere or Step Recovery Diode (both internal to the SYTM) are produced. Symptoms of squegging are power reversal (actual RF output power decreases as selected RF output power is increased), power holes in the RF output, and spurious responses on the RF output.

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

NOTE

After you have peaked the power in the band you are adjusting, you can determine the approximate power per division on the oscilloscope (for a specific vertical sensitivity) by perform the following. Press [MANUAL] and note the power level in the POWER dBm display. Press [SHIFT] [PWR SWP] and set the ALC level, using the DUT's front panel rotary knob, to the noted power level. Turn the rotary knob counter-clockwise to place the dot on the oscilloscope to a convenient horizontal graticule and note the power level in the POWER dBm display. Turn the rotary knob counter-clockwise to place the dot on the next horizontal graticule and note the power level. The difference between the two readings is the dB/Div sensitivity on the oscilloscope. Repeat this procedure for several horizontal divisions on the scope since the dB/Div will change slightly as the power level is changed (due to the output characteristics of the detector). If you wish to verify the sensitivity at other frequencies, press [MANUAL] and turn the rotary knob for the desired frequency and then repeat this procedure. After completing this procedure, press [RECALL] [1] to return to the instrument state required for the adjustments.

11. If the trace goes off the oscilloscope display in the following adjustments, adjust the vertical position and/or sensitivity controls to view the entire trace on the display.

    Adjust A24R3 (X2A) to optimize the power in the first half of the display.

    Adjust A24R4 (X2B) to optimize the power in the second half of the display.

    If the output power begins to decrease while adjusting one of these potentiometers (pots) clockwise (i.e., power reversal, squegging), adjust the pot counter-clockwise until the power is peaked again and then continue turning the pot counter-clockwise until the power is reduced $\cong$ 0.5 dB.

    It may be desirable to optimize the power in one half of the band (maximum power with no squegging), even though squegging is induced in the other half. One would do this if the side being adjusted is significantly lower in power than the other half. Once the power is optimized, adjust the bias in the other half (using the pot for that half) to eliminate squegging. Iterate between the two adjustments to optimize the power and to ensure that there is no squegging in either half.

    If squegging occurs in the center of the swept display (one division left or right of center), adjust X2A counter-clockwise to eliminate the squegging. Adjusting X2A to eliminate squegging in the center of the band will hopefully force the SRD BIAS test point (A24TP12) into a slight upward slope.

12. Adjust A28R6 (OFST) and A28R82 (GAIN) for optimum power across the entire display.

13. Repeat step 11. After this, disconnect the detector and connect the scope probe to A24TP12 (SRD BIAS) as shown in Figure 5-40. Adjust the scope's vertical sensitivity to view the waveform on TP12. If TP12 exhibits a slight upward slope, as shown in Figure 5-42, proceed to step 14. If TP12 exhibits a flat or downward slope, adjust X2A until a upward slope is displayed on TP12 (do not adjust X2A more than 1/8 of a turn). If adjusting X2A does not provide an upward slope on TP12, adjust X2B until a upward slope is displayed on TP12 (do not adjust X2B more than 1/8 of a turn). If neither of these adjustments provide an upward slope on TP12, repeat steps 9 through 13.

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

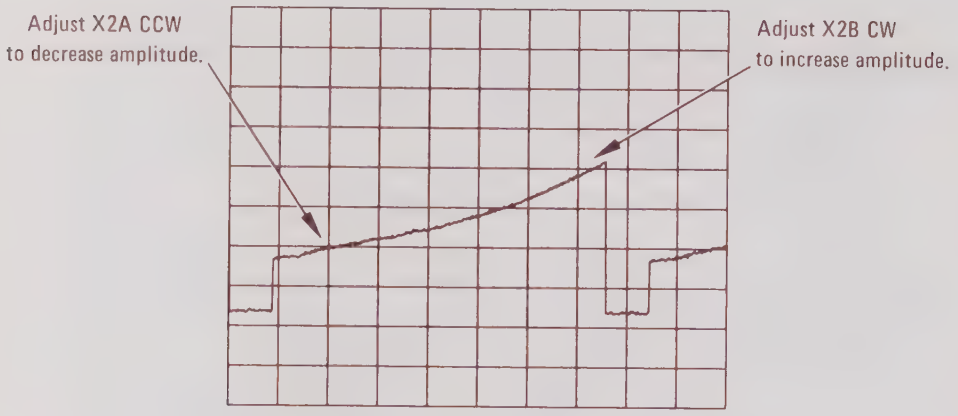


Figure 5-42. Oscilloscope Display of SRD Bias Waveform

14. Disconnect the oscilloscope probe and reconnect the detector as shown in Figure 5-40. Set the oscilloscope's vertical sensitivity (CHAN A) to 0.5 V/Div. Readjust the vertical position and/or sensitivity, if necessary, to view the entire trace on the scope. Note the position of the minimum power point.

15. Press **[MANUAL]** on the DUT. Adjust the front panel rotary knob until the dot on the scope is near the position noted as the minimum power point. Slowly vary the position of the dot around this point while observing the DUT's POWER dBm display. The minimum power displayed should be $>$ 1 dB above the maximum leveled power specification for the DUT in Band 2 (6.9 to 13.5 GHz). If this is not the case, disconnect the detector from the DUT and connect the power meter and power sensor. Again, slowly vary the rotary knob and determine the power level of the minimum power point. If it is still $<$ 1 dB above the maximum leveled power specification, press **[RECALL] [1]** on the DUT and repeat steps 9 through 15.

Band 3 Adjustments

16. On the DUT, press

    [START FREQ] [1] [3] [.] [3] [5] [GHz]
    [STOP FREQ] [2] [0] [GHz]
    [CONT]
    [SAVE] [1]

    Adjust the scope's vertical position and/or sensitivity control to display the swept RF output.

17. Adjust A28R99 (BP1) to peak the power in the second half of the display. This pot may need to be adjusted several turns before any effect is observed.

18. If the trace goes off the oscilloscope display in the following adjustments, adjust the vertical position and/or sensitivity controls to view the entire trace on the display.

    Adjust A24R6 (X3A) to optimize the power in the first half of the display.

    Adjust A24R7 (X3B) to optimize the power in the second half of the display.

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

If the output power begins to decrease while adjusting one of these potentiometers (pots) clockwise (i.e., power reversal, squegging), adjust the pot counter-clockwise until the power is peaked again and then continue turning the pot counter-clockwise until the power is reduced $\cong$ 0.5 dB.

It may be desirable to optimize the power in one half of the band (maximum power with no squegging), even though squegging is induced in the other half. One would do this if the side being adjusted is significantly lower in power than the other half. Once the power is optimized, adjust the bias in the other half (using the pot for that half) to eliminate squegging. Iterate between the two adjustments to optimize the power and to ensure that there is no squegging in either half.

19. Adjust A28R99 (BP1) to peak the power in the second half of the display.

20. Access Cal Constant 73 by pressing **[SHIFT] [GHz] [7] [3] [Hz] [SHIFT] [ENTRY OFF]** on the DUT. Using the DUT's rotary knob, adjust Cal Constant 73 to peak the power across the entire band (adjust above and below 1024). Repeat steps 19 and 20.

21. Repeat step 18.

22. Note the position of the minimum power point on the scope. On the DUT, press **[MANUAL]**. Adjust the DUT's rotary knob until the dot on the scope is near the position noted as the minimum power point. Slowly vary the position of the dot around this point while observing the DUT's POWER dBm display. The minimum power displayed should be $>$ 1 dB above the maximum leveled power specification for the DUT in Band 3 (13.35 to 20 GHz). If this is not the case, disconnect the detector from the DUT and connect the power meter and power sensor. Again, slowly vary the rotary knob and determine the power level of the minimum power point. If it is still $<$ 1 dB above the maximum leveled power specification, press **[CONT]** on the DUT and repeat steps 17 through 22.

Band 4 Adjustments (HP 8340B Only)

If adjusting an HP 8341B, proceed to step 31.

23. On the DUT, press

    [START FREQ] [1] [9] [.] [8] [GHz]
    [STOP FREQ] [2] [6] [.] [5] [GHz]
    [CONT]
    [SAVE] [1]

    Adjust the scope's vertical position and/or sensitivity to display the swept RF output.

24. Adjust A28R24 (BP2 FREQ) to peak the power across the band. If this adjustment has no effect or reduces the power, return A28R24 to full clockwise and proceed immediately to step 26 (step 25 will not be required).

25. Adjust A28R25 (BP3 FREQ) to peak the power in the second half of the display. If A28R25 has no effect or reduces the power, return the pot to full clockwise. Adjust A28R27 (BP2) to peak the power across the band. If A28R25 (BP3 FREQ) was adjusted from full clockwise, adjust A28R28 (BP3) to optimize the power in the second half of the display.

26. If the trace goes off the oscilloscope display in the following adjustments, adjust the vertical position and/or sensitivity controls to view the entire trace on the display.

    Adjust A24R9 (X4A) to optimize the power in the first half of the display.

Adjust A24R10 (X4B) to optimize the power in the second half of the display.

If the output power begins to decrease while adjusting one of these potentiometers (pots) clockwise (i.e., power reversal, squegging), adjust the pot counter-clockwise until the power is peaked again and then continue turning the pot counter-clockwise until the power is reduced $\cong$ 0.5 dB.

It may be desirable to optimize the power in one half of the band (maximum power with no squegging), even though squegging is induced in the other half. One would do this if the side being adjusted is significantly lower in power than the other half. Once the power is optimized, adjust the bias in the other half (using the pot for that half) to eliminate squegging. Iterate between the two adjustments to optimize the power and to ensure that there is no squegging in either half.

27. If BP2 FREQ and BP2 have been adjusted, readjust them for maximum power across the band. If BP3 FREQ and BP3 have been adjusted, readjust them for maximum power in the second half of the display.

28. Access Cal Constant 74 by pressing **[SHIFT] [GHz] [7] [4] [Hz] [SHIFT] [ENTRY OFF]** on the DUT. Using the DUT's rotary knob, adjust Cal Constant 74 to peak the power across the entire band (adjust above and below 1024).

29. Repeat step 26.

30. Note the position of the minimum power point on the scope. On the DUT, press **[MANUAL]**. Adjust the DUT's rotary knob until the dot on the scope is near the position noted as the minimum power point. Slowly vary the position of the dot around this point while observing the DUT's POWER dBm display. The minimum power displayed should be $>$ 1 dB above the maximum leveled power specifications for the DUT in Band 4 (19.8 to 26.5 GHz). If this is not the case, disconnect the detector from the DUT and connect the power meter and power sensor to the attenuator. Again, slowly vary the rotary knob and determine the power level of the minimum power point. If it is still $<$ 1 dB above the maximum leveled power specification, press **[CONT]** on the DUT and repeat steps 23 through 30.

SYTM Auto Tracking (8340B and 8341B)

31. Press **[SHIFT] [PEAK]** on the DUT. The DUT's ENTRY DISPLAY will display "AUTO TRACKING CALIBRATION". Wait for this display to turn off and then press **[INSTR PRESET].**

SYTM DELAY COMPENSATION ADJUSTMENTS BY BAND

Band 4 Delay Compensation (HP 8340B), Band 3 Delay Compensation (HP 8341B)

32. Connect the scope and detector as shown in Figure 5-40. The scope should be set for A vs B mode.

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

33. Press the following key sequence on the DUT:

For an HP 8340B

[INSTR PRESET]
[START FREQ] [1] [9] [.] [8] [GHz]
[XTAL]
[SWEEPTIME] [2] [0] [0] [msec]
[SAVE] [1]
[SWEEPTIME] [AUTO]
[SAVE] [2]
[SINGLE]
[SAVE] [3]
[RECALL] [2]

For an HP 8341B

[INSTR PRESET]
[START FREQ] [1] [3] [.] [3] [5] [GHz]
[XTAL]
[SWEEPTIME] [2] [0] [0] [msec] (500 mS if the DUT has Option 003)
[SAVE] [1]
[SWEEPTIME] [AUTO]
[SAVE] [2]
[SINGLE]
[SAVE] [3]
[RECALL] [2]

34. Adjust the scope's vertical and horizontal sensitivity to view the swept display. The horizontal gain should be set so the trace covers the full display from left to right.

35. Access Calibration Constant 75 by pressing the following key sequence on the DUT:

[SHIFT] [GHz] [7] [5] [Hz]
[SHIFT] [MHz] [1] [2] [Hz]
[SHIFT] [kHz] [2] [2] [Hz]

NOTE

The range for the delay compensation Cal constants, numbers 2 through 8, is 0 to 131. If the Cal Constants do not provide sufficient range for the delay compensation, Cal Constant 8 should be lowered (Cal Constant 7 for the HP 8341B) , A28R22 (DYO) and A28R19 (DYS) readjusted, and then the SYTM DELAY COMPENSATION ADJUSTMENTS BY BAND procedure should be repeated.

36. Adjust A28R22 (DYO) for optimum power in the first half of the display. Ignore the small power dropout at the beginning of the sweep, this will be eliminated later.

37. Adjust A28R19 (DYS) for optimum power in the second half of the display. Iterate between steps 36 and 37 until optimum power is achieved across the band.

38. Using the DUT's rotary knob, adjust Cal Constant 75 (range is 0 to 500) to optimize the power in the first division (left hand side) of the display (i.e., eliminate the small power dropout).

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

39. Press **[RECALL]** on the DUT and iterate between registers 1 and 2 by pressing **[1]** and then **[2]**. Verify that the fast sweep speed trace (register 2) is no more than ≅ 1 dB below the slow sweep speed trace (register 1) at any point. Also, the minimum power point on the fast sweep speed trace should be > 1 dB above the maximum leveled power specifications for the Band. If either of the above conditions are not met, repeat steps 36 through 40.

40. Iterate between registers 1 and 3 and press **[SINGLE]** (initiates the single sweep) after selecting register 3. Verify that the single sweep trace (register 3) is no more than 1 db below the slow sweep trace (register 1) at any point. Also, the minimum power point on the single sweep trace should be > 1 dB above the maximum leveled power specifications for the Band. If either of the above conditions are not met, repeat steps 36 through 40.

    If the DUT is an HP 8341B, proceed to step 51.

Band 3 Delay Compensation, HP 8340B

41. Press the following key sequence on the DUT:

    [CONT] (If not already in continuous sweep mode)
    [START FREQ] [1] [3] [.] [3] [5] [GHz]
    [STOP FREQ] [2] [0] [GHz]
    [SWEEPTIME] [2] [0] [0] [msec]
    [SAVE] [7]
    [SWEEPTIME] [AUTO]
    [SAVE] [8]
    [SINGLE]
    [SAVE] [9]
    [RECALL] [8]

    Adjust the scope's vertical position and/or sensitivity to view the swept display.

42. Access Cal Constant 7 by pressing **[SHIFT] [GHz] [7] [Hz] [SHIFT] [ENTRY OFF]** on the DUT.

43. Using the DUT's rotary knob, adjust Cal Constant 7 (range is 0 to 131) to optimize the power across the entire Band. If Cal Constant 7 is unable to optimize (peak) the majority of Band 3 at the same time (> 60% of the Band should peak at the same time), then proceed with step 44. Otherwise, proceed with step 50.

44. On the DUT, press **[1] [0] [0] [Hz]** to return Cal Constant 7 to 100. Repeat steps 36 and 37.

45. Press **[RECALL]** on the DUT and iterate between registers 7 and 8 by pressing **[7]** and then **[8]**. Verify that the fast sweep speed trace (register 8) is no more than ≅ 1 dB below the slow sweep speed trace (register 7) at any point. Also, the minimum power point on the fast sweep speed trace should be > 1 dB above the maximum leveled power specifications for Band 3. If either of the above conditions are not met, repeat steps 42 through 45.

46. Iterate between registers 7 and 9 and verify that the single sweep trace (register 9) is no more than 1 db below the slow sweep trace at any point. After pressing **[9]** on the DUT you need to press **[SINGLE]** to initiate the single sweep. Also, the minimum power point on the single sweep trace should be > 1 dB above the maximum leveled power specifications for Band 3. If either of the above conditions are not met, repeat steps 42 through 46.

47. Press **[RECALL] [2]** on the DUT (recalls the Band 4 fast sweep setup). Adjust the scope's vertical position and/or sensitivity to view the swept display.

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

48. Access Cal Constant 8 by pressing **[SHIFT] [GHz] [8] [Hz] [SHIFT] [ENTRY OFF]** on the DUT. Using the DUT's rotary knob, adjust Cal Constant 8 (range is 0 to 131) for optimum power across Band 4.

49. Press **[RECALL]** on the DUT and iterate between registers 1 and 2 by pressing **[1]** and then **[2]**. Verify that the fast sweep speed trace (register 2) is no more than $\cong$ 1 dB below the slow sweep speed trace (register 1) at any point. Also, the minimum power point on the fast sweep speed trace should be $>$ 1 dB above the maximum leveled power specifications for the Band. If either of the above conditions are not met, repeat steps 46 through 49.

    Proceed with step 51.

50. Perform steps 45 and 46.

Band 2 Delay Compensation, HP 8340B and 8341B

51. Press the following key sequence on the DUT:

    [CONT] (If not already in continuous sweep mode)
    [START FREQ] [6] [.] [9] [GHz]
    [STOP FREQ] [1] [3] [.] [5] [GHz]
    [SWEEPTIME] [2] [0] [0] [msec] (500 mS if the DUT is an HP 8341B Option 003)
    [SAVE] [1]
    [SWEEPTIME] [AUTO]
    [SAVE] [2]
    [SINGLE]
    [SAVE] [3]
    [RECALL] [2]

    Adjust the scope's vertical position and/or sensitivity to view the swept display.

52. Access Cal Constant 6 by pressing **[SHIFT] [GHz] [6] [Hz] [SHIFT] [ENTRY OFF]** on the DUT. Using the DUT's rotary knob, adjust Cal Constant 6 (range is 0 to 131) to optimize the power across the entire Band.

53. Press **[RECALL]** on the DUT and iterate between registers 1 and 2 by pressing **[1]** and then **[2]**. Verify that the fast sweep speed trace (register 2) is no more than $\cong$ 1 dB below the slow sweep speed trace (register 1) at any point. Also, the minimum power point on the fast sweep speed trace should be $>$ 1 dB above the maximum leveled power specifications for Band 2. If either of the above conditions are not met, repeat steps 52 and 54.

54. Iterate between registers 1 and 3 and verify that the single sweep trace (register 3) is no more than 1 db below the slow sweep trace at any point. After pressing **[3]** on the DUT you need to press **[SINGLE]** to initiate the single sweep. Also, the minimum power point on the single sweep trace should be $>$ 1 dB above the maximum leveled power specifications for Band 2. If either of the above conditions are not met, repeat steps 52 through 54.

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

Band 1 Delay Compensation

55. Press the following key sequence on the DUT:

    [CONT] (If not already in continuous sweep mode)
    [SHIFT] [METER] [-] [5] [0] [dBm]
    [START FREQ] [2] [.] [3] [GHz]
    [STOP FREQ] [7] [.] [0] [GHz]
    [SWEEPTIME] [2] [0] [0] [msec] (500 mS if the DUT is an HP 8341B Option 003)
    [SAVE] [1]
    [SWEEPTIME] [AUTO]
    [SAVE] [2]
    [SINGLE]
    [SAVE] [3]
    [RECALL] [2]

    Adjust the scope's vertical position and/or sensitivity to view the swept display. The SHIFT METER mode is being implemented to allow the Band 1 delay compensation to be adjusted without any squegging[2] present.

56. Access Cal Constant 5 by pressing **[SHIFT] [GHz] [5] [Hz] [SHIFT] [ENTRY OFF]** on the DUT. Using the DUT's rotary knob, adjust Cal Constant 5 (range is 0 to 131) to optimize the power across the entire Band.

57. Press **[RECALL]** on the DUT and iterate between registers 1 and 2 by pressing **[1]** and then **[2]**. Verify that the fast sweep speed trace (register 2) is no more than 2 dB below the slow sweep speed trace (register 1) at any point. If this condition is not met, repeat steps 56 and 57.

58. Iterate between registers 1 and 3 and verify that the single sweep trace (register 3) is no more than 2 db below the slow sweep trace at any point. After pressing **[3]** on the DUT you need to press **[SINGLE]** to initiate the single sweep. If this condition is not met, repeat steps 56 through 58.

Multiband Delay Compensation Adjustments

59. Press the following key sequence on the DUT:

    [INSTR PRESET]
    [START FREQ] [2] [.] [3] [GHz]
    [XTAL]
    [SWEEPTIME] [1] [sec]
    [SAVE] [1]
    [SWEEPTIME] [AUTO]
    [SAVE] [2]
    [SINGLE]
    [SAVE] [3]
    [RECALL] [2]

    Adjust the scope's vertical position and/or sensitivity to view the swept display.

---

2. Squegging in Band 1 (2.3 to 7.0 GHz) is seen as large power drop outs and spurious signals on the RF output. Band 1 squegging is a function of input power into the SYTM and cannot be adjusted out. Band 1 squegging will only occur if maximum available power is requested from the DUT (i.e., maximum unleveled power). Since this is the case, Band 1 squegging will normally not occur when the DUT is set to maximum specified power and below.

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

60. Access Cal Constant 4 by pressing the following key sequence on the DUT:

    [SHIFT] [GHz] [4] [Hz]
    [SHIFT] [MHz] [1] [2] [Hz]
    [SHIFT] [kHz] [2] [2] [Hz].

    If the DUT is an HP 8341B, proceed to step 62.

61. Using the DUT's rotary knob, adjust Cal Constant 4 (range is 0 to 131) to optimize the power in Band 4.

62. Access Cal Constant 3 by pressing the **[▼]** step key. Using the DUT's rotary knob, adjust Cal Constant 3 (range is 0 to 131) to optimize the power in Band 3.

63. Access Cal Constant 2 by pressing the **[▼]** step key. Using the DUT's rotary knob, adjust Cal Constant 2 (range is 0 to 131) to optimize the power in Band 2.

64. Access Cal Constant 77 by pressing **[SHIFT] [GHz] [7] [7] [Hz] [SHIFT] [ENTRY OFF]** on the DUT. Using the DUT's rotary knob, adjust Cal Constant 77 (range is −25 to +25) for optimum power at the band switch points. If this Cal Constant has no effect, reset it to −25.

65. Press the **[▲]** step key to access Cal Constant 78. Using the DUT's rotary knob, adjust Cal Constant 78 (range is −25 to +25) for optimum power at the band switch points. If this Cal Constant has no effect, reset it to +25.

66. Press **[RECALL]** on the DUT and iterate between registers 1 and 2 by pressing **[1]** and then **[2]**. Verify that the fast sweep speed trace (register 2) is no more than 1 dB below the slow sweep speed trace (register 1) at any point (ignore squegging which is most likely occurring in Band 1). Also, the minimum power point on the fast sweep speed trace should be > 1 dB above the maximum leveled power specifications for each band (again, ignore squegging in Band 1). If either of the above conditions are not met, repeat steps 59 through 66.

67. Iterate between registers 1 and 3 and verify that the single sweep trace (register 3) is no more than 2 db below the slow sweep trace at any point (ignore squegging which is most likely occurring in Band 1). After pressing **[3]** on the DUT you need to press **[SINGLE]** to initiate the single sweep. Also, the minimum power point on the single sweep trace should be > 1 dB above the maximum leveled power specifications for each band (again, ignore squegging in Band 1). If either of the above conditions are not met, repeat steps 59 through 67.

68. Press the following key sequence on the DUT:

    [RECALL] [2]
    [SHIFT] [GHz] [1] [Hz]
    [SHIFT] [ENTRY OFF] [5] [0] [0] [Hz] (Sets Cal Constant 1 to 500)

    Adjust A28R13 (DRP) for optimum power across the entire frequency range.

69. Press the following key sequence on the DUT:

    [50] [Hz] (Resets Cal Constant 1 to 50)
    [SHIFT] [MHz] [1] [4] [Hz]
    [SHIFT] [kHz] [5] [3] [4] [9] [Hz]

    Wait for "CALIBRATION STORED" to be displayed in the DUT's ENTRY DISPLAY and then press **[INSTR PRESET].**

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

UNLEVELED SQUEGGING TEST USING THE HP 8566B SPECTRUM ANALYZER

Description

The DUT's RF output signal is down converted using a Local Oscillator and a mixer. The IF output of the mixer is fed to a spectrum analyzer. Any squegging of the DUT will appear as a spurious response on the IF signal.

This test should be performed after adjusting the SYTM tracking and delay, and the SRD unleveled bias. Since unleveled squegging can be difficult to see using the oscilloscope, this test is performed to determine if additional adjustments are required.

Equipment Required

Synthesized Sweeper ..... HP 8340B Option 001
10 dB Attenuator ..... HP 8493C Option 010
Mixer ..... HP P/N 0955-0307
Spectrum Analyzer ..... HP 8566B
Adapters
APC 3.5 (f) To Type N (m) (required if DUT is HP 8341B) ..... HP P/N 1250-1744
APC 3.5 (f) to APC 3.5 (f) ..... HP P/N 5061-5311
(1 required if DUT is an HP 8341B; 2 required if DUT is an HP 8340B)

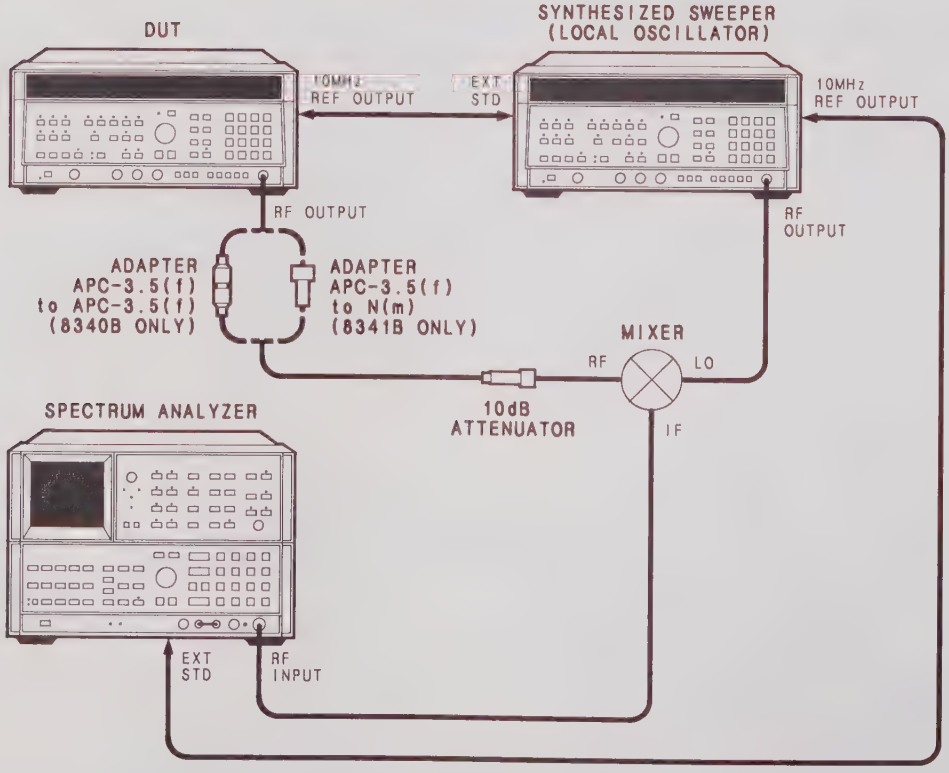


Figure 5-43. Unleveled Squegging Test Setup

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

70. Connect equipment as shown in Figure 5-43. Connect the mixer at the Local Oscillator's (LO) RF output connector to obtain maximum mixer LO input level. Set the LO and spectrum analyzer to external standard. Allow at least 30 minutes warm up time.

71. Press the Local Oscillator **[INSTR PRESET]**. Press **[START FREQ]** and enter **[6] [.] [4] [GHz]**. Press **[STOP FREQ]** and enter **[1] [2] [.] [9] [GHz]**. Press **[POWER LEVEL]** and enter **[1] [0] [dBm]**. Press **[SHIFT] [CF]** and enter **[1] [0] [0] [MHz]** for a step size of 100 MHz. Press **[MANUAL]** SWEEP and enter **[6] [.] [4] [GHz]** to set the Local Oscillator to CW at 6.4 GHz. Press **[PEAK]** to turn on peaking.

72. Press **[INSTR PRESET]** on the DUT. Press **[START FREQ]** and enter **[7] [GHz]**. Press **[STOP FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[POWER LEVEL]** and enter **[2] [0] [dBm]**. UNLEVELED indicator should be on. Press **[SHIFT] [CF]** and enter **[1] [0] [0] [MHz]** for a step size of 100 MHz. Press **[MANUAL]** SWEEP and enter **[7] [GHz]**. The mixer IF frequency is now 600 MHz.

73. Set the Spectrum Analyzer as follows:

FULL SPAN	0 - 2.5 GHz
RES BW	300 kHz
VIDEO BW	100 kHz
START FREQ	590 MHz
STOP FREQ	800 MHz
REFERENCE LEVEL	−10 dBm
ATTEN	0 dB

Press HOLD to retain these settings. The 600 MHz IF signal should be near the left side of the Spectrum Analyzer CRT.

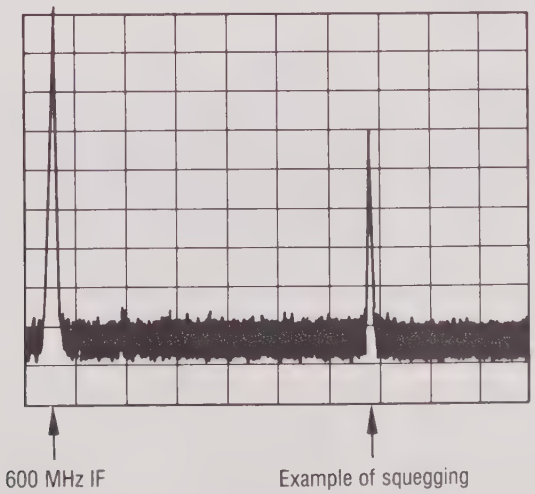


Figure 5-44. Unleveled Squegging Displayed on Spectrum Analyzer

5-14. UNLEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

74. Using the [▲] key on both the DUT and the LO, step through Band 2, observing the Spectrum Analyzer display at each step. There may be responses due to mixing products. These will appear as low level signals. A squegging response will appear as a higher amplitude signal as shown in Figure 5-44. If squegging occurs at DUT frequencies below 10 GHz, adjust A24R3 (X2A) slightly CCW to eliminate squegging. If squegging occurs at frequencies above 10 GHz, adjust A24R4 (X2B) to eliminate the squegging. Note, if the control is adjusted and there is no effect on the response, the response is probably a mixing product.

75. For Band 3, press the Local Oscillator **[START FREQ]** and enter **[1] [2] [.] [9] [GHz]**. Press **[STOP FREQ]** and enter **[1] [9] [.] [4] [GHz]**. Press **[MANUAL]** and enter **[1] [2] [.] [9] [GHz]**.

76. On the DUT press **[POWER LEVEL]** and enter **[2] [0] [dBm]**. Press **[START FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[STOP FREQ]** and enter **[2] [0] [GHz]**. Press **[MANUAL]** and enter **[1] [3] [.] [5] [GHz]**.

77. Using the step keys as described in step 26, step through Band 3. If squegging occurs below 15 GHz, adjust A24R6 (X3A) slightly CCW to eliminate the squegging. If squegging occurs above 15 GHz, adjust A24R7 (X3B).

Band 4 Adjustments, HP 8340B only

78. For Band 4, press the Local Oscillator **[START FREQ]** and enter **[1] [9] [.] [4] [GHz]**. Press **[STOP FREQ]** and enter **[2] [5] [.] [9]**. Press **[MANUAL]** and enter **[1] [9] [.] [4] [GHz]**.

79. On the DUT press **[START FREQ]** and enter **[2] [0] [GHz]**. Press **[STOP FREQ]** and enter **[2] [6] [.] [5] [GHz]**. Press **[POWER LEVEL]** and enter **[2] [0] [dBm]** Press **[MANUAL]** and enter **[2] [0] [GHz]**.

80. Using the step keys as described in step 26, step through Band 4. If squegging occurs below 23 GHz, adjust A24R9 (X4A) slightly CCW to eliminate the squegging. If squegging occurs above 23 GHz, adjust A24R10 (X4B).

NOTE

If adjustments of the calibration constants were made in this procedure, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence: [SHIFT] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz] [INSTR PRESET].

5-15. ALC ADJUSTMENTS

Reference

Performance Test: Maximum Leveled Output Power and Accuracy
Service Section: RF Section

LOGGER TEMPERATURE COMPENSATION

Description

NOTE

The following logger temperature compensation procedure should only be done if either A11 or A12 Detector is replaced.

The logger in A25 has temperature compensation in both high and low bands. This procedure calculates the values for the four factory-selected resistors in the temperature compensation circuit.

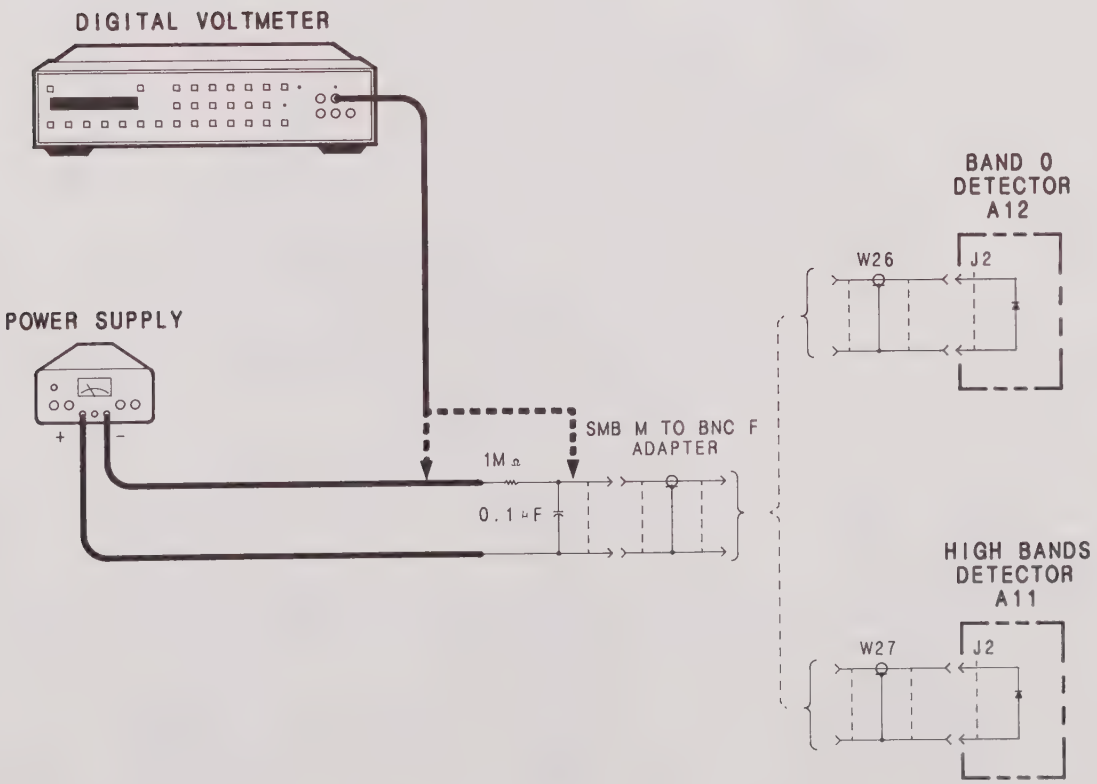


Figure 5-45. Logger Temperature Compensation Test Setup

5-15. ALC ADJUSTMENTS (Cont'd)

Equipment

Power Supply	HP 6294A
Digital Voltmeter (DVM)	HP 3456A
1 Megohm Resistor	HP P/N 0757-0059
0.1 UF Capacitor	HP P/N 0160-0168
Extender Board	HP P/N 08350-60031

Procedure

1. Disconnect AC power cable from the DUT and allow it to cool for at least two hours.
2. Disconnect cables W26 and W27 from A25J2 and A25J1 respectively (Figure 5-46), and remove the A25 PC board from the instrument.

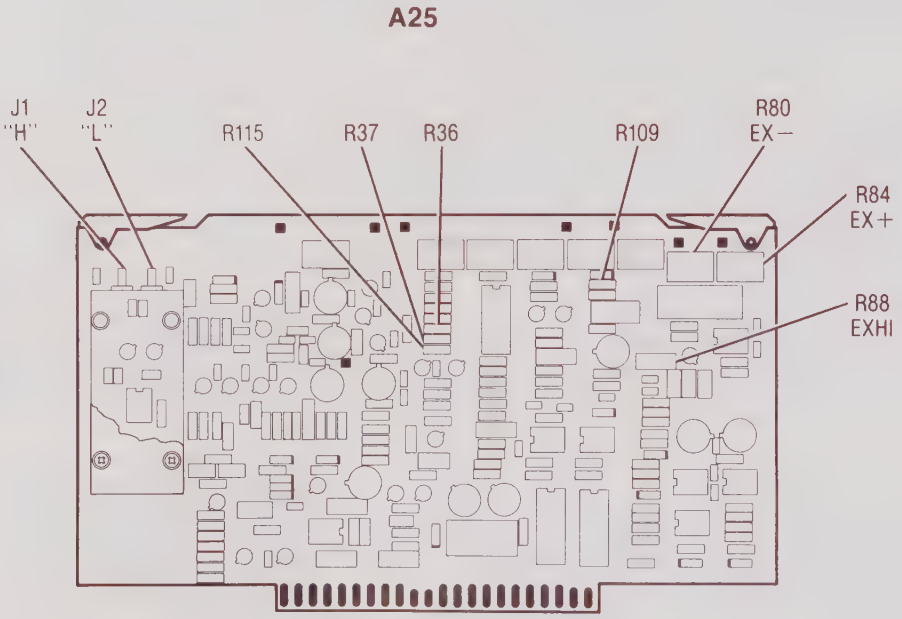


Figure 5-46. ALC Detector A25 Temperature Compensation Adjustments Location

3. Install an Extender Board in place of A25.
4. Set the DVM for Ohms measurement and connect the input between pins 4 and 26 of the extender board. Note the resistance measured. This value is thermistor resistance, R_T, and will be used for calculations in later steps.
5. Connect the test equipment as shown in Figure 5-45 with cable W27 connector connected to an SMB-to-BNC adapter.
6. Connect the DVM across the output terminals of the Power Supply and adjust the power supply output for 5.00 ± 0.01 Vdc. Move the DVM connections back to the SMB-to-BNC adapter as shown in Figure 5-45.

5-15. ALC ADJUSTMENTS (Cont'd)

7. Note indication on the DVM. This value is V_{VM} for high band and will be used for calculations in step 8.

8. Calculate "Corrected Video Resistance in Hi Band," R_{VH}, as follows:

$$R_{VH} = (R_{VM} - 100) \times 24000/(R_T + 4000)$$

where:

R_{VH} = Corrected Video Resistance in High Band

$R_{VM} = V_{VM}$ = Value measured in step 7 above.

R_T = Thermistor Resistance measured in step 4 above.

9. Use the Value of R_{VH} found in step 8 above and select the resistance values for A25R36 and A25R37 from Table 5-6.

10. Disconnect the high band detector A11 cable W27 from the SMB-to-BNC adapter and connect the low band detector A12 cable W26 to the adapter as shown in Figure 5-45.

11. Connect the DVM at the output of the Power Supply and check that the output is still at 5.00 ± 0.01 Vdc. Move the DVM connections back to the SMB-to-BNC adapter as shown in Figure 5-45.

12. Note indication on the DVM. This value is V_{VM} for low band and will be used for calculations in step 13.

13. Calculate "Corrected Video Resistance in Low Band," R_{VL}, as follows:

$$R_{VL} = (R_{VM} - 680) \times 24000/(R_T + 4000)$$

where:

R_{VL} = Corrected Video Resistance in Low Band

$R_{VM} = V_{VM} \times 200$ Ohms/mV

V_{VM} = Value measured in step 12 above.

R_T = Thermistor Resistance measured in step 4 above.

14. Use the value of R_{VL} found in step 13 above and select resistance values for A25R109 and A25R115 from Table 5-7.

Table 5-6. Selected Values of High Band Temperature Compensation Resistors in A25

R_{VH} (Ohms)	A25R36 (Ohms)	A25R37 (Ohms)
800-870	9090	6190
870-950	8250	5620
950-1050	7500	5620
1050-1160	6810	5110
1160-1270	6190	4640
1270-1380	5620	4220
1380-1490	5110	4220
1490-1600	4640	3830

5-15. ALC ADJUSTMENTS (Cont'd)

Table 5-7. Selected Values of Low Band Temperature Compensation Resistors in A25

R_{VL} (Ohms)	A25R109 (Ohms)	A25R115 (Ohms)
800-870	3830	9090
870-950	3480	8250
950-1050	3160	7500
1050-1160	2870	6810
1160-1270	2370	6190
1270-1380	2150	5620
1380-1490	1960	5110
1490-1600	1620	4640

ALC ADJUSTMENTS

Description

The ALC detectors have a linear region. Below the linear region the detector response is non-linear. The ALC circuit attempts to compensate for the non-linear regions such that the overall response of the ALC loop is linear over a 40 dB range from −20 dBm to +20 dBm. Since there is a separate detector and modulator for the high bands (Bands 1 - 4) and low band (Band 0), there are separate adjustments for the high bands and low band.

The DUT is set to a CW frequency within the band to be adjusted. The RF attenuator and ALC is set for de-coupled operation (controlled separately). The RF output level is set using the ENTRY keys. The power is measured with a power meter and if necessary adjustments are made until the power meter indication is correct at each DUT power level.

Equipment

Power Meter ..... HP 436A
Power Sensor ..... HP 8485A
Digital Voltmeter (DVM) ..... HP 3456A
Power Supply ..... HP 6294A
Adapters
APC 3.5 (f) To Type N (m) (8341B only) ..... HP P/N 1250-1744
APC 3.5 (f) To APC 3.5 (f) (8340B only) ..... HP P/N 5061-5311

NOTE

The ALC circuit contains several adjustment controls and the adjustment includes changing calibration constants stored in memory. All of the adjustments in each band interact with each other. In addition, the high band 0 dBm adjustment affects the low band, and the high bands +18 dBm adjustment affects the low band. Before making any adjustments, check the operation of the ALC circuit as described below and make adjustments only if necessary.

NOTE

In the following procedures, do not put P.C. boards on extender boards.

5-15. ALC ADJUSTMENTS (Cont'd)

15. Connect the equipment as shown in Figure 5-47. Calibrate and zero the power meter. Allow one hour warmup time. Connect the power sensor to the DUT's RF output. Press **[INSTR PRESET]** on the DUT. Press **[CW]** and enter **[4] [.] [5] [GHz]**. Press the **[RF]** key to turn the RF OFF and zero the power meter. To ensure that the power meter is properly zeroed, select "WATT" mode, and press ZERO until the power meter indicates $\leq$0.02 on the most sensitive range. Press **[RF]** to turn the RF ON. Press **[PEAK]** to turn peaking on. Press **[SHIFT] [PWR SWP]** to decouple the RF attenuator and ALC. Enter **[0] [dBm]**. If the display does not indicate ATTEN=0 dB, press STEP keys as necessary to select 0 dB attenuation.

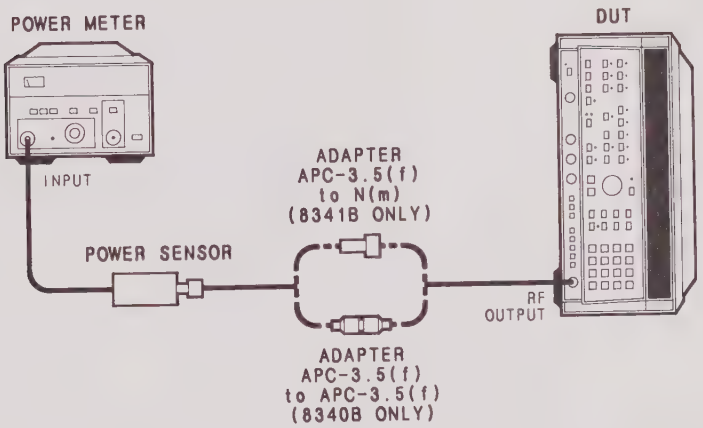


Figure 5-47. ALC Adjustment Test Setup

NOTE

When the power level is changed significantly, it may take as long as one minute for the power meter indication to be accurate. After making a power level change, wait until the power meter indication stabilizes before making any adjustments.

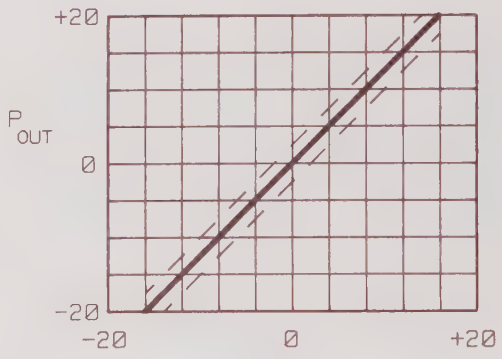
16. Refer to Table 5-8 below, enter the appropriate DUT power level (ALC level) and check the power meter indication. Check the indication at each power level and note the amount of error before making any adjustments. If necessary, adjust the appropriate controls shown in the table to adjust the power level to be within the test limit shown.

    Adjustments are iterative. Adjust in the following order:

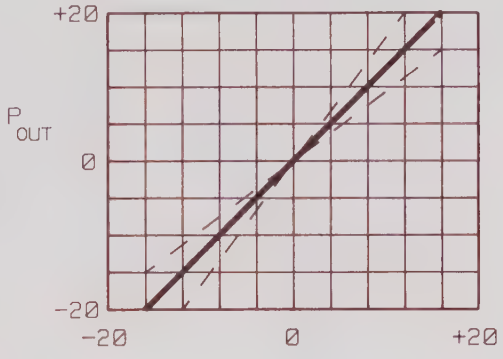
    0 dBm, −10 dBm, −20 dBm, −10 dBm, 0 dBm, +10 dBm, +18 dBm, and +10 dBm.

    When selecting a new power level, press **[SHIFT] [PWR SWP] [desired power level] [dBm]**.

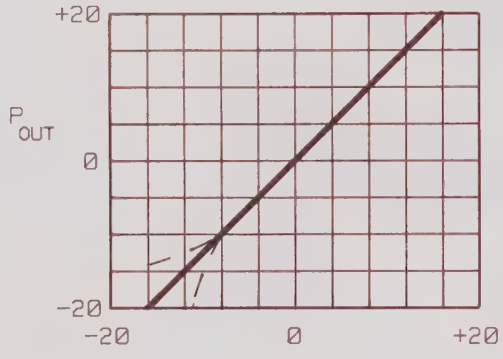
    See Figure 5-48 for more information that may help to reduce the number of iterations required. For example, if the +18 dBm indication is 0.1 dB low (+17.9 dBm), adjust for 0.05 dB high (+18.05 dBm). Then when the +10 is adjusted to +10 dBm, the +18 will move close to the correct level.



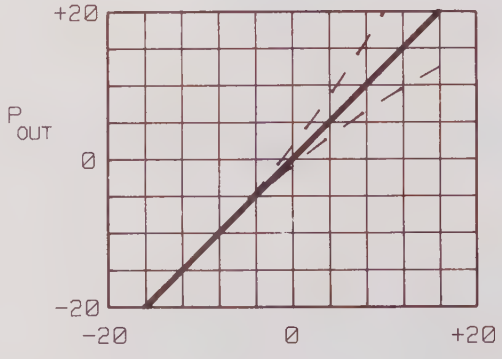
0dBm ADJUSTMENT OFFSETS ENTIRE CURVE BY THE SAME AMOUNT.



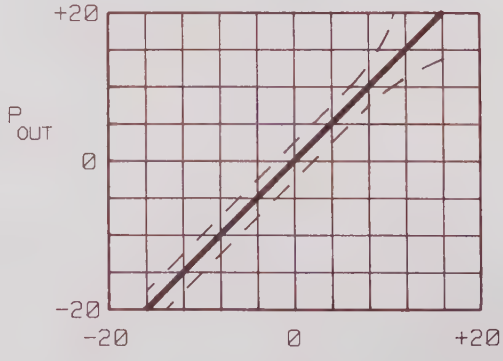
-10dBm ADJUSTMENT ROTATES CURVE AROUND THE 0dBm POINT. THUS IT STRONGLY AFFECTS -20 AND +18dBm POINTS.



-20dBm ADJUSTMENT HAS SLIGHT EFFECT AT -10dBm, NEGLIGIBLE ELSEWHERE.



+10dBm ADJUSTMENT STRONGLY AFFECTS +18dBm, SLIGHTLY AFFECTS 0, NEGLIBIBLE ELSEWHERE.



+18dBm ADJUSTMENT HAS MODERATE EFFECT ON +10dBm, SLIGHTLY LESS EFFECT AT ALL LOWER POWERS.

Figure 5-48. Typical ALC Adjustment Response Curves

5-15. ALC ADJUSTMENTS (Cont'd)

Table 5-8. High Band ALC Adjustment

DUT Power Level	Associated Adjustment	Check Limit	Adjustment Limit
−20 dBm	A25R34 (H-20)	0.3 dB	0.2 dB
−10 dBm	Calibration Constant #47*	0.1 dB	0.02 dB
0 dBm	Calibration Constant #44*	0.1 dB	0.02 dB
10 dBm	A25R39 (H+10)	0.1 dB	0.02 dB
18 dBm	A25R24 (+20)	0.2 dB	0.05 dB

* Access Calibration Constant Number 47 by entering the following: **[SHIFT] [GHz] [4] [7] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Use **[STEP]** key to change Cal. Constant Number to 44.

17. If all power meter indications are within the test limits, check at power levels from −20 dBm to +20 dBm in 5 dB steps.

18. Press **[CW]** and enter **[1] [.] [5] [GHz]**. Press **[SHIFT] [PWR SWP]** to decouple the RF attenuator and ALC. Enter **[0] [dBm]**. Press **[SHIFT] [METER]** and enter**[−] [1] [0] [0] [dBm]**. Dashes should be displayed in the POWER dBm display. If not, rotate the RPG counter-clockwise until the dashes appear (note that the UNLEVELED annunciator will be on at this time). Zero the power meter in "WATT" mode as described in step 15. The low band (Band 0) contains broadband noise. If the power meter is properly zeroed, the broadband noise will be compensated and power measurements will be more accurate. Press **[INT]** (UNLEVELED annunciator off) and then **[SHIFT] [PWR SWP]** (attenuator and ALC should both indicate zero).

19. Refer to Table 5-9 below, enter the appropriate DUT power level (ALC level) and check the power meter indication. Check the indication at each power level and note the amount of error before making any adjustments. If necessary adjust the appropriate controls shown in the table to adjust the power level to be within the test limits.

    Adjustments are iterative. Adjust in the following order:

    0 dBm, −10 dBm, −20 dBm, −10 dBm, 0 dBm, and +10 dBm.

    When selecting a new power level, press **[SHIFT] [PWR SWP] [desired power level] [dBm]**.

Table 5-9. Low Band ALC Adjustment

DUT Power Level	Associated Adjustment	Check Limit	Adjustment Limit
−20 dBm	A25R33 (L-20)	0.3 dB	0.2 dB
−10 dBm	Calibration Constant #46*	0.1 dB	0.02 dB
0 dBm	A25R108 (LOFS)	0.1 dB	0.02 dB
10 dBm	A25R38 (L+10)	0.1 dB	0.02 dB
There is no low band +20 dBm adjustment.			

* Access Calibration Constant Number 46 by entering the following: **[SHIFT] [GHz] [4] [6] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**.

5-15. ALC ADJUSTMENTS (Cont'd)

20. If all power meter indications are within the test limit, check at power levels from −20 dBm to +10 dBm in 5 dB steps.

NOTE

If adjustments of the calibration constants were made in this procedure, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence: [SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz]. Wait for "CALIBRATION RESTORED" to be displayed in the ENTRY DISPLAY and then press [INSTR PRESET].

EXTERNAL LEVELING ADJUSTMENTS

NOTE

The negative external Xtal leveling adjustments include two variable resistor adjustments (+6 dBV and −60 dBV) and two calibration constant adjustments (−30 dBV and 0 dBV). These adjustments interact similarly to the ALC adjustments. See Figure 5-49 for more information that may help to reduce the number of iterations required. Note that the curve rotates about the −30 dBV level.

21. Connect a negative Xtal detector to the DUT RF output. Connect a BNC Tee at the detector output. Connect a BNC cable from one output of the Tee to the DUT's LEVELING EXT INPUT. Connect another BNC cable from the BNC Tee to a DVM. Set the DVM for a floating input and connect a 0.1 UF capacitor across its terminals.

    Make adjustments in the following order:

    −30 dBV, 0 dBV, +6 dBV, 0 dBV, −30 dBV, and −60 dBv.

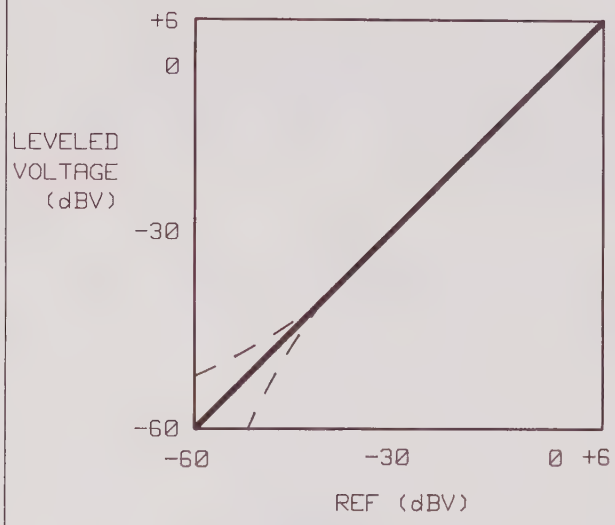
22. Press **[INSTR PRESET]**. Press **[CW]** and enter **[4] [.] [5] [GHz]**. Press **[XTAL]** leveling. The ENTRY DISPLAY should indicate ATN: 0 dB, REF −30.00 dBV. Adjust calibration constant Number 45 for a DVM indication of −31.6 mV ± 0.3 mV. Access Calibration Constant Number 45 by entering the following: **[SHIFT] [GHz] [4] [5] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz].**

23. Press **[POWER LEVEL]** and enter **[0] [dBm]**. Adjust calibration constant Number 48 for a DVM indication of −1.00 volts ±0.01 volts. Access Calibration Constant Number 48 by entering the following: **[SHIFT] [GHz] [4] [8] [Hz] [SHIFT] [ENTRY OFF]**.

24. Press **[POWER LEVEL]** and enter **[6] [dBm]**. The ENTRY DISPLAY REF level should be +6 dBV. Adjust A25R88 (EXHI, see Figure 5-46) for a DVM indication of −2.00 volts ±0.02 volts. The +6 dB adjustment will affect the 0 dBV level as well. To minimize the number of iterations, over adjust the +6 dBV level, then when the 0 dBV level is adjusted, the +6 dBV level will be close. For example, if the +6 dBV indication is 0.1V low, adjust for 0.15V high.

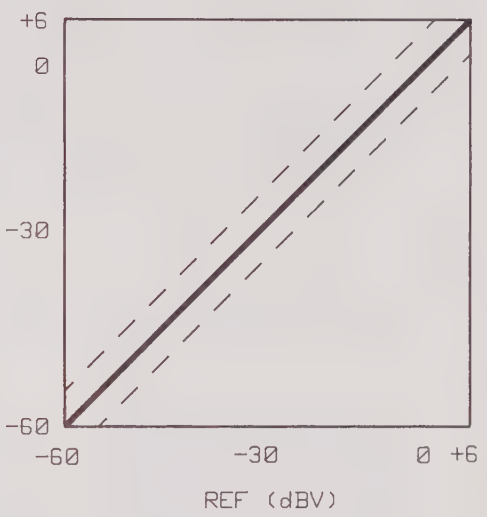
25. Press **[XTAL]** and enter **[−] [6] [0] [dBm]**. Adjust A25R80 (EX−) for a DVM indication of −1.000 mV ±0.01 mV. Repeat all negative external leveling adjustments, in the order given, until all DVM indications are within ±1%.

26. Connect a positive Xtal detector in place of the negative Xtal detector. Press [▼] twice to set the RF attenuator set to 20 dB and the REF set to −60 dBV, adjust A25R84 (EX+) for +1.000 mV ±0.01 mV.



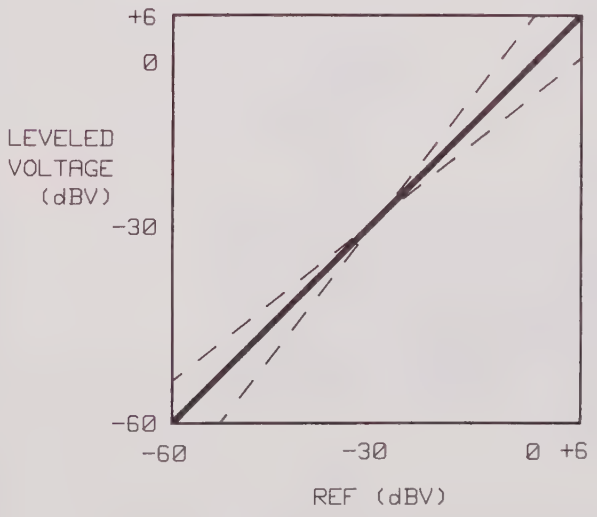
-60dBV ADJUSTMENT HAS NEGLIGIBLE EFFECT ELSEWHERE.

(EX-/EX+)



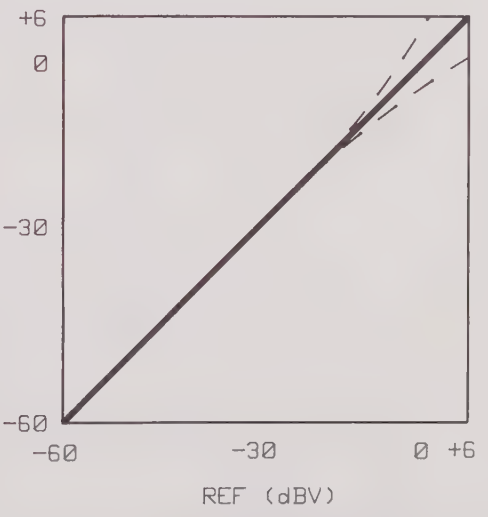
-30dBV ADJUSTMENT OFFSETS ENTIRE CURVE BY THE SAME AMOUNT.

(CAL NO. 45)



0dBV ADJUSTMENT ROTATES CURVE ABOUT THE -30dBv POINT. THUS IT AFFECTS -60 AND +6dBV STRONGLY.

(CAL NO. 48)



+6dBV ADJUSTMENT HAS STRONG EFFECT ON 0dBV, NEGLIGIBLE ELSEWHERE.

(A25R88)

Figure 5-49. Typical External Leveling Response Curves

5-15. ALC ADJUSTMENTS (Cont'd)

ADJUST AM OFFSET

27. Connect the Power Sensor to the DUT's RF OUTPUT. Press **[INSTR PRESET]**. Press **[CW]** and enter **[1] [GHz]**. The power level should be 0 dBm. Disconnect any AM inputs. Access Calibration Constant Number 43 by entering the following: **[SHIFT] [GHz] [4] [3] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]**. Adjust Calibration Constant Number 43 for no more than 0.05 dB change in power meter indication when turning AM on then off.

AM GAIN ADJUSTMENT

28. Set up the following equipment as shown in Figure 5-50 with the power supply set to 0 Vdc. Allow the equipment to warm up for at least 30 minutes.

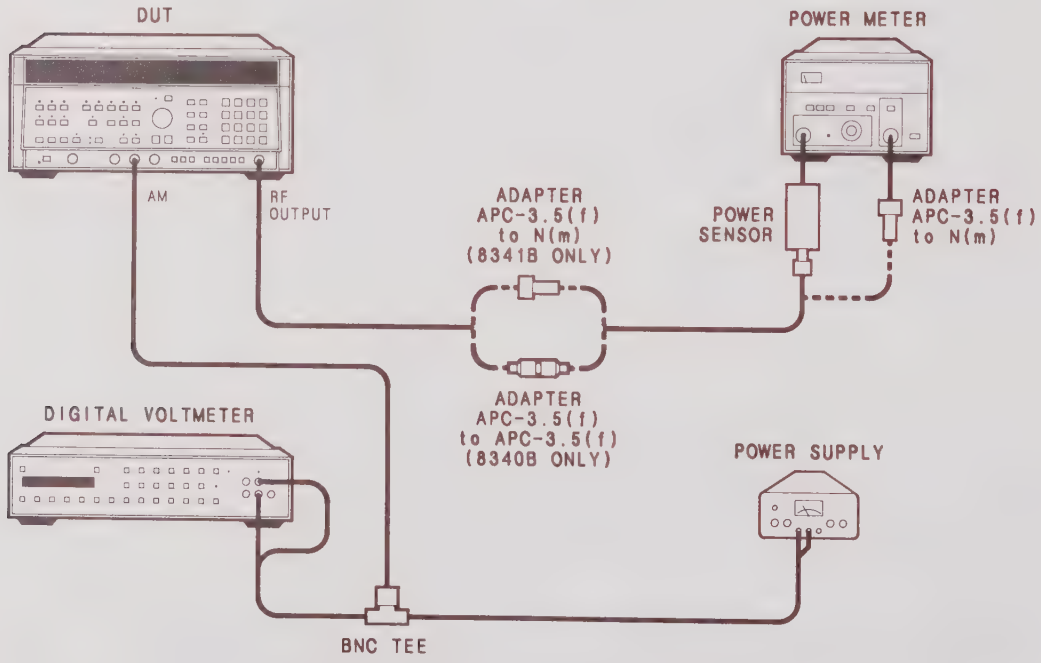


Figure 5-50. AM GAIN Adjustment Test Setup

29. Calibrate the power meter and then set the calibration factor switch for a 1.5 GHz measurement. Connect the power sensor to the DUT's RF output.

30. Press the following key sequence on the DUT:

    [INSTR PRESET]
    [CW] [1] [.] [5] [GHz]
    [POWER LEVEL] [−] [5] [dBm]
    [AM].

31. Adjust the power supply for 0 Vdc. Press dB **[REF]** on the power meter (the power meter will now indicate the power level changes from this reference).

5-15. ALC ADJUSTMENTS (Cont'd)

32. Adjust the power supply for +0.3 Vdc. The power meter indication should be between 2.18 to 2.38 dB. If the indication is not in this range, adjust A26R91 (AM GAIN, Figure 5-51) for a power meter indication within the given range.

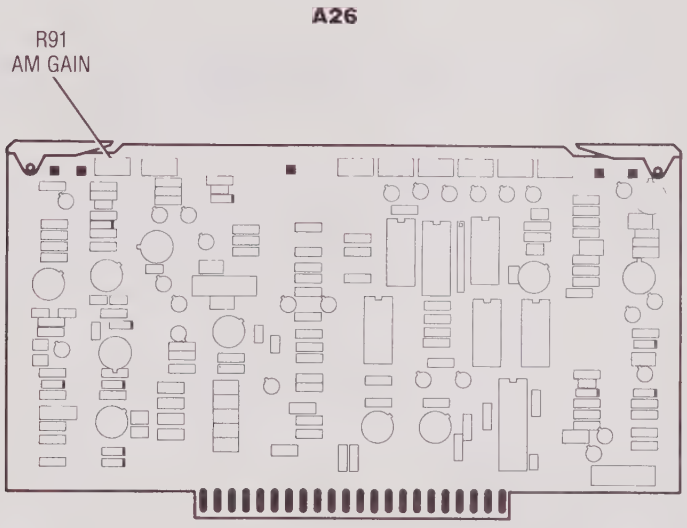


Figure 5-51. A26 Linear Modulator Component Location Diagram

33. Adjust the power supply for −0.3 Vdc. The power meter indication should be between −2.91 and −3.29 dB. If the indication is not in this range, adjust A26R91 (AM GAIN) for a power meter indication within the given range.

34. Repeat steps 32 and 33 until the power level requirements are met for each step.

NOTE

If adjustments of the calibration constants were made in this procedure, the data thus stored in the "working memory area" should be copied to the "protected memory area" by pressing the following key sequence: [SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz]. Wait for "CALIBRATION RESTORED" to be displayed in the ENTRY DISPLAY and then press [INSTR PRESET].

5-16. LEVELED RF OUTPUT ADJUSTMENTS

Reference

Performance Test: Maximum Leveled Output Power and Accuracy
Service Section: RF Section

Description

In this procedure, the RF output signal is checked in leveled mode. An oscilloscope and detector are used to adjust the Step Recovery Diode (SRD, internal to the SYTM) for optimum bias and to eliminate the possible occurrence of "squegging".

In the next procedure, the ALC loop gain in each band is adjusted for optimum operation.

A final section checks the RF output signal with a Spectrum Analyzer for the appearance of squegging in any of the bands and allows a last fine adjustment to eliminate any squegging that is observed.

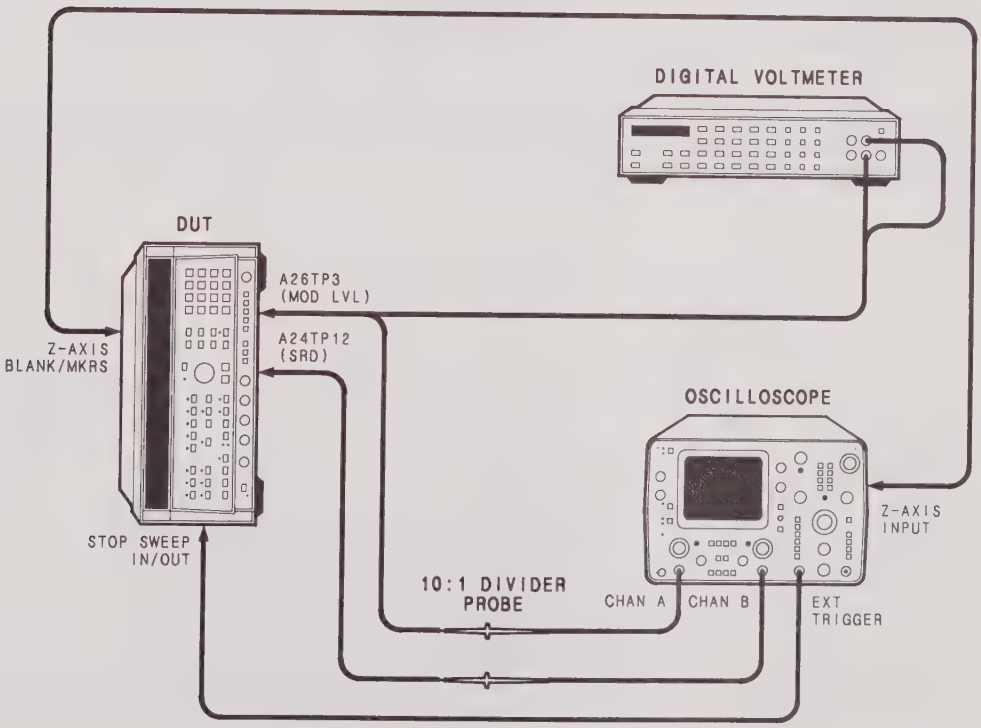


Figure 5-52. Leveled Power SRD Bias Adjustment Test Setup

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

Equipment

Oscilloscope	HP 1741A
10:1 Divider Probe, 2 Required	HP 10004D
Detector	HP 8473C
Digital Voltmeter (DVM)	HP 3456A
Adapters:	
APC 3.5 (f) to APC 3.5 (f) (HP 8340B only)	HP P/N 5061-5311
APC 3.5 (f) — Type N (m) (HP 8341B only)	HP P/N 1250-1744
Dual Banana to BNC (f)	HP P/N 1251-2277
BNC (f) — Clip Lead	HP P/N 8120-1292

Procedure

MODULATOR OFFSET

1. Connect the DVM to A26TP3 (MOD LVL). Preset A26R88 (MO) fully clockwise (Figure 5-53). Turn the DUT's LINE switch ON and allow 30 minutes warm up.

2. Press **[INSTR PRESET]** on the DUT. Press **[CW] [8] [GHz]**. Press **[SHIFT] [METER]** to bypass the ALC circuit and allow direct control of the linear modulator circuit.

3. Adjust the front panel rotary knob (RPG) for a DVM indication of 0.00 V + 3 mV, then note the indication in the POWER dBm display. Adjust A26R88 (MO) counter-clockwise to decrease the POWER dBm indication by 0.2 dB.

LEVELED BIAS

4. Disconnect the DVM and connect the oscilloscope as shown in Figure 5-52.

5. Set the oscilloscope as follows:

DISPLAY	CHANNEL A
CHAN A	0.02 V/Div DC COUPLED
TRIGGER	EXT. POS.
TIME/Div	5 mS

6. On the DUT, press **[INSTR PRESET] [START FREQ] [7] [GHz] [STOP FREQ] [1] [3] [.] [5] [GHz]**. Press **[SHIFT] [PWR SWP] [-] [2] [0] [dBm]**. Press **[SWEEP TIME] [5] [0] [msec]**.

   Save this instrument state by pressing **[SAVE] [2]**.

7. The oscilloscope display should be similar to Figure 5-54. Adjust A24R12 (MIN) so that all points on the trace are reduced to the lowest possible voltage level (i.e., maximum negative voltage).

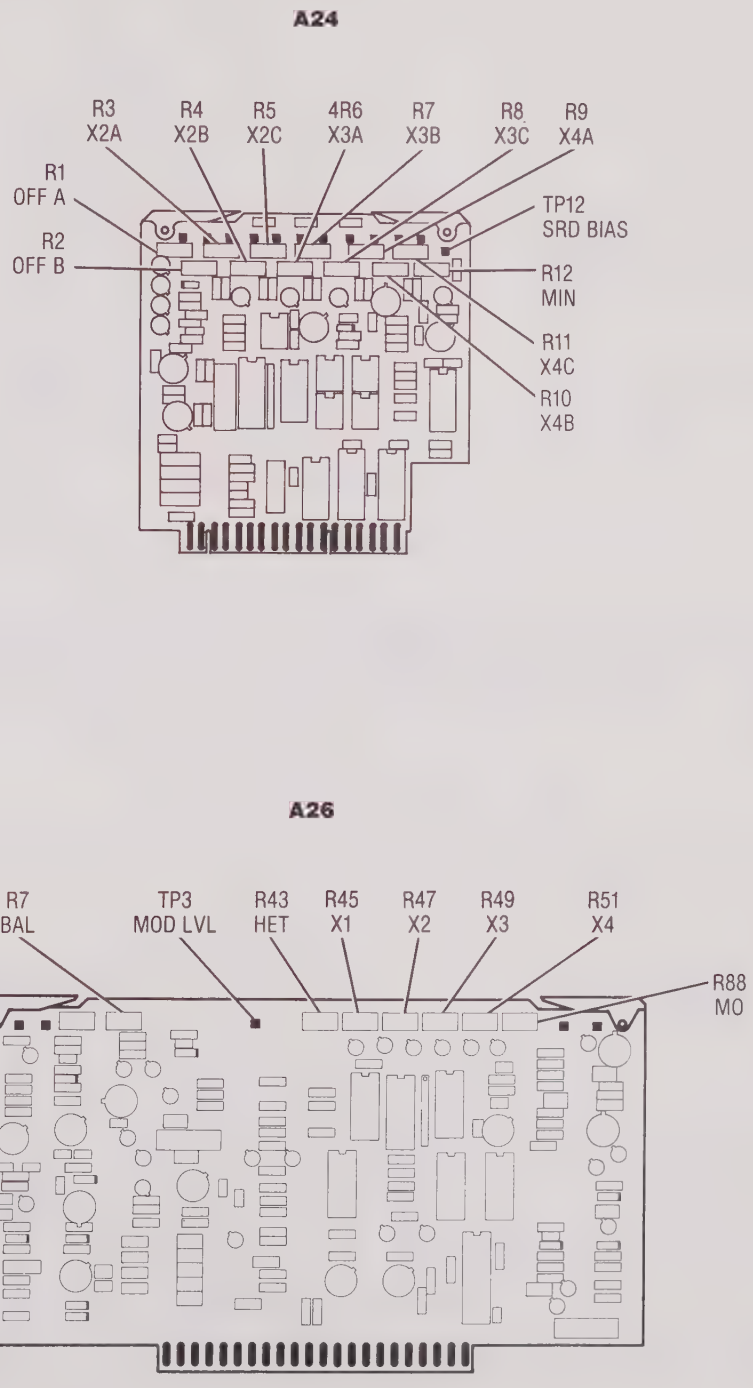


Figure 5-53. SRD Bias Adjustments on A24 and A26

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

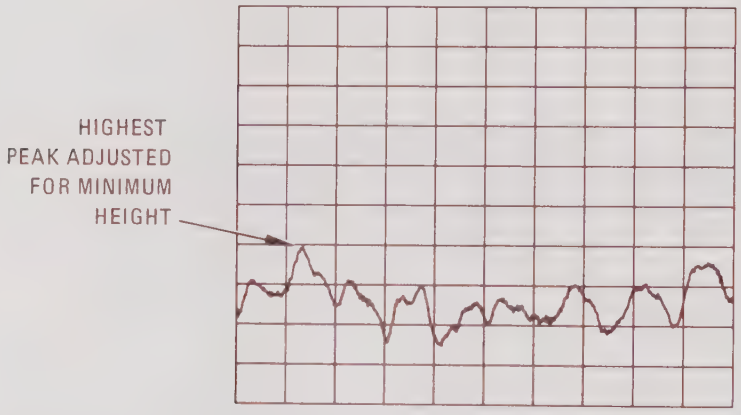


Figure 5-54. Oscilloscope Display at A26TP3 MOD LVL with no Squegging

8. On the DUT, press **[INSTR PRESET] [SHIFT] [CF]** and enter **[2] [0] [0] [MHz]** for a CW step size of 200 MHz. Press **[SWEEP TIME] [5] [0] [msec]**. Press **[SHIFT] [PWR SWP]** to decouple the RF attenuator and ALC, and enter **[-] [2] [0] [dBm]**. Press **[PWR SWP] [4] [0] [dBm]** and **[AM]** to turn the AM on. Press **[CW] [8] [GHz]**. This puts the DUT in power sweep from −20 to +20 dB at any frequency selected.

   Save this instrument state by pressing **[SAVE] [1]**.

9. Preset A24R1 (OFF A) (Figure 5-53), A24R2 (OFF B), A24R5 (X2C), A24R8 (X3C), and A24R11 (X4C) controls fully counter-clockwise.

10. Set the oscilloscope as follows:

    DISPLAY ..... CHOP
    CHAN A ..... 0.05 V/Div DC COUPLED
    CHAN B ..... 0.05 V/Div DC COUPLED

    The oscilloscope display should look similar to Figure 5-55.

LEVELED POWER SRD BIAS ADJUSTMENT

11. Adjust A24R1 (OFF A) for optimum display as shown in Figure 5-55, Waveforms A, B, and C.

12. On the DUT, press **[CW] [1] [3] [GHz]**. Adjust A24R2 (OFF B) for optimum trace as shown in Figure 5-55, Waveforms A, B, and C.

13. On the DUT, press **[CW] [1] [0] [GHz]**. Adjust A24R5 (X2C) to minimize the MOD LEVEL voltage (Channel A) at the start of the power sweep and keep the MOD LEVEL power sweep trace straight with no step or bows as it sweep up (see Figure 5-55, Waveforms D and E).

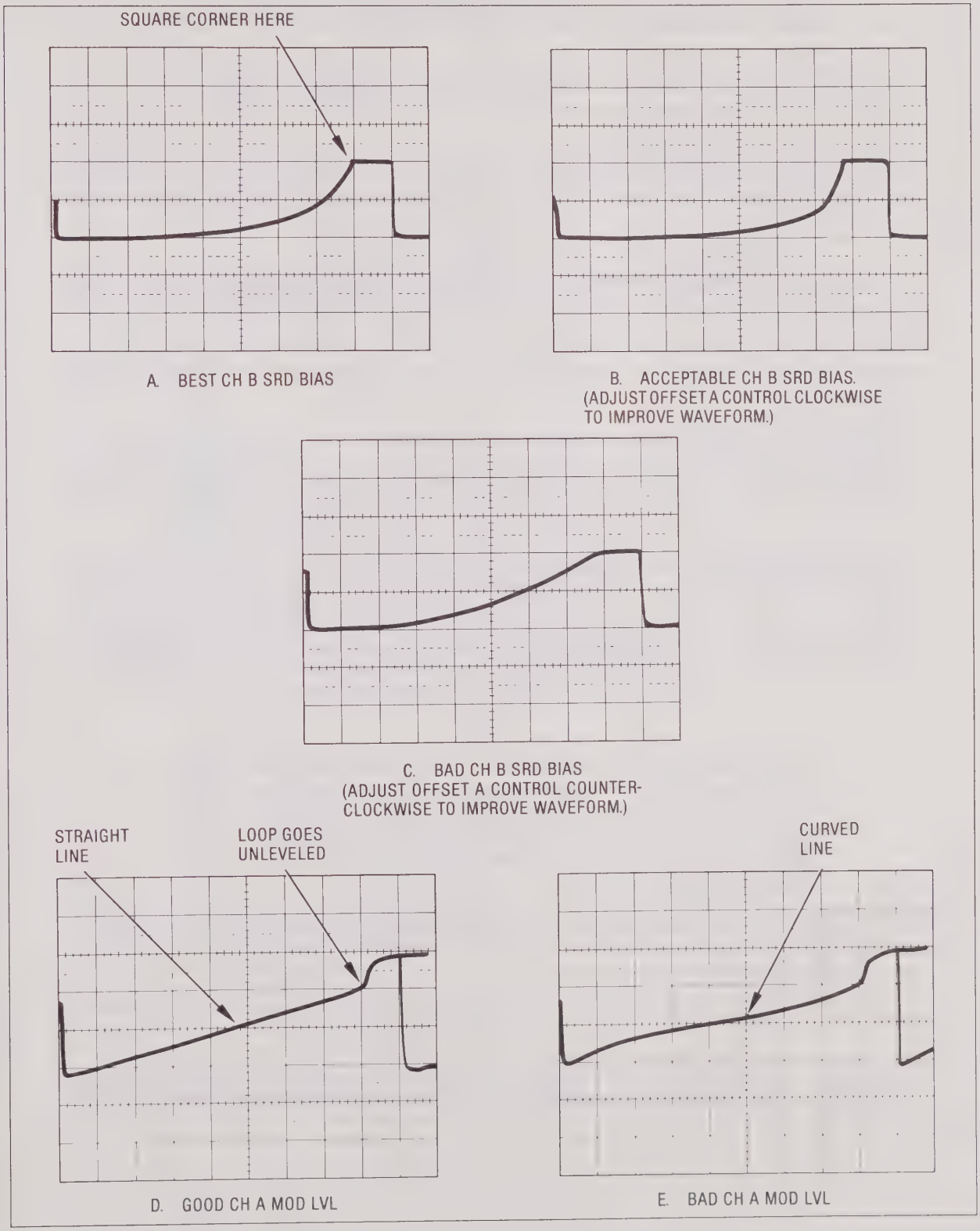

SQUARE CORNER HERE
A. BEST CH B SRD BIAS
B. ACCEPTABLE CH B SRD BIAS. (ADJUST OFFSET A CONTROL CLOCKWISE TO IMPROVE WAVEFORM.)
C. BAD CH B SRD BIAS (ADJUST OFFSET A CONTROL COUNTER-CLOCKWISE TO IMPROVE WAVEFORM.)
STRAIGHT LINE
LOOP GOES UNLEVELED
CURVED LINE
D. GOOD CH A MOD LVL
E. BAD CH A MOD LVL

Figure 5-55. Typical MOD LVL and SRD BIAS Waveforms

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

14. On the DUT, press **[CW] [1] [7] [.] [5] [GHz].** Adjust A24R8 (X3C) for a MOD LEVEL trace as described in step 13.

    If the DUT is an HP 8341B, proceed with step 16.

15. On the DUT, press **[CW] [2] [3] [.] [3] [GHz]** and adjust A24R11 (X4C) for a MOD LEVEL trace as described in step 13.

16. Set the oscilloscope to DISPLAY A and set CHAN A to 0.02 V/Div.

17. Press **[RECALL] [2]** on the DUT. The oscilloscope display should be similar to Figure 5-54. Adjust A24R12 (MIN) so that all points on the trace are reduced to the lowest possible voltage level (i.e., maximum negative voltage).

18. On the DUT, press **[RECALL] [1] [CW] [7] [GHz].** Set the oscilloscope for DISPLAY CHOP, CHAN A to 0.5 V/Div, and CHAN B to 0.5 V/Div.

19. Using the DUT's [▲] and [▼] step keys, step through Band 2 from 7 to 13.4 GHz and check for an optimum SRD bias trace (Figure 5-55, Waveform A, B, and C) at each step. If not optimum, adjust A24R1 (OFF A) if the frequency is closer to 7 GHz, or adjust A24R2 (OFF B) if the DUT frequency is closer to 13.5 GHz. If an adjustment is made, step through the entire band again, making sure every step is optimized or acceptable if all the steps cannot be optimized.

20. Using the DUT's [▲] and [▼] step keys, step through Band 2 from 7 to 13.4 GHz and readjust A24R5 (X2C) if necessary to improve the MOD LEVEL trace. Also, adjust A24R1 (OFF A) and A24R2 (OFF B) if necessary to optimize the SRD Bias as in step 19 above. If any adjustments are made, step through Band 2 again until the SRD bias and the MOD LEVEL trace is optimized. It will not be possible to adjust the MOD LEVEL trace for optimum at each step, so adjust for best compromise trace across Band 2 (see Figure 5-55, Waveforms D and E).

NOTE

The SRD bias trace is adjusted in Band 2 with A24R1 (OFF A) and A24R2 (OFF B) set for optimum. It should not require any other adjustments in Bands 3 or 4, unless the SRD bias trace is bad as shown in Figure 5-55. If either the OFF A or OFF B controls are adjusted in Bands 3 or 4, then each band will have to be rechecked, starting with Band 2 at 7 GHz and stepping through each band.

21. On the DUT, press **[CW] [1] [3] [.] [5] [GHz]**. Using the DUT's [▲] and [▼] step keys, step through Band 3 from 13.5 to 19.9 GHz and readjust A24R8 (X3C) if necessary to achieve the best MOD LEVEL trace across Band 3.

    If the DUT is an HP 8341B, proceed to the LINEAR MODULATOR ALC LOOP GAIN ADJUSTMENTS.

22. On the DUT, press **[CW] [2] [0] [.] [1] [GHz]**. Using the DUT's step keys, step through Band 4 from 20.1 to 26.5 GHz and readjust A24R11 (X4C) if necessary for the best MOD LEVEL trace across Band 4.

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

LINEAR MODULATOR ALC LOOP GAIN ADJUSTMENTS

Description

The following adjustments are performed to set the ALC loop gain for each band. The adjustment is done in the power sweep mode, while sweeping the ALC loop from −20 to maximum power.

NOTE

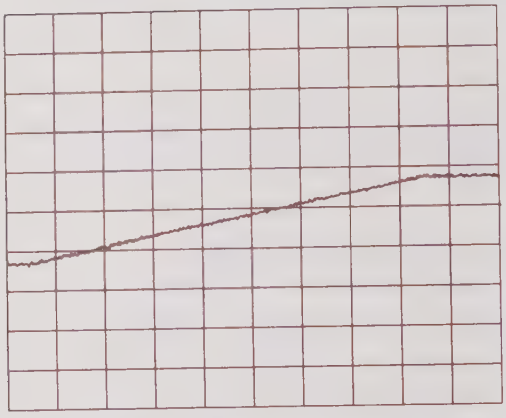
If the A26 Linear Modulator assembly has not been replaced, adjustments may not be necessary.

23. Connect CHAN A of the oscilloscope to A26TP3 (MOD LVL). Connect CHAN B to A25TP2 (DET). Set up the oscilloscope as follows:

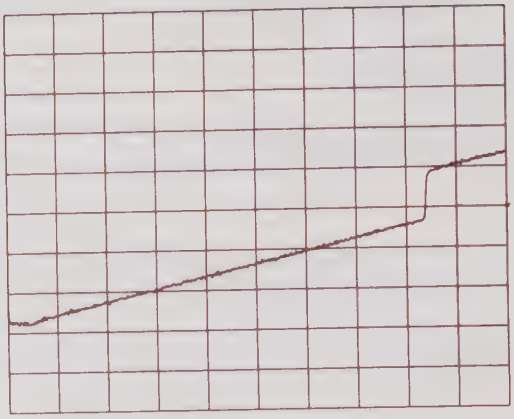
DISPLAY	CHOP
CHAN A	0.05V Div DC COUPLED
CHAN B	0.05V/Div DC COUPLED
TRIGGER	EXT. POS.
TIME/Div	5 mS
SWEEP VERNIER	ON

24. On the DUT, press **[INSTR PRESET] [SWEEP TIME] [5] [0] [msec]**. Press **[SHIFT] [PWR SWP] [-] [2] [0] [dBm]**. Press **[PWR SWP] [4] [0] [dBm]**. Press **[SHIFT] [CF] [2] [0] [0] [MHz]** and then **[AM]** to turn AM on. Press **[CW] [1] [0] [MHz]**.

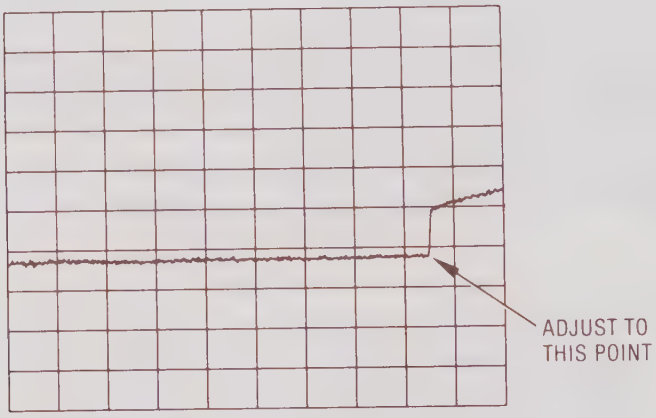
    The oscilloscope display should be similar to Figure 5-56, Waveforms A and B. It may be necessary to adjust the SWEEP VERNIER to view the entire sweep.



A. TYPICAL DET WAVEFORM



B. TYPICAL MOD LVL WAVEFORM



C. TYPICAL MOD LVL MINUS DET WAVEFORM

Figure 5-56. Typical MOD LVL and DET Waveforms for ALC Loop Gain Adjustment

NOTE

In steps 25 through 29, the oscilloscope display will be adjusted for the most horizontal line. This adjustment is only concerned with the trace up to where it deviates from a flat line (see Figure 5-56, Waveform C). This point on the display will change position with frequency.

25. On the oscilloscope, invert CHAN B and select DISPLAY A + B mode. Using the DUT's step keys, step the CW frequency through Band 0 from 10 MHz to 2.21 GHz and adjust A26R43 (HET) for the most horizontal line across Band 0.

26. On the DUT, press **[CW] [2] [.] [3] [GHz].** Using the DUT's step keys, step the CW frequency through Band 1 from 2.3 to 6.9 GHz and adjust A26R45 (X1) for the most horizontal line across Band 1.

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

27. On the DUT, press **[CW] [7] [GHz].** Using the DUT's step keys, step the CW frequency through Band 2 from 7.0 to 13.4 GHz and adjust A26R47 (X2) for the most horizontal line across Band 2.

28. On the DUT, press **[CW] [1] [3] [.] [5] [GHz].** Using the DUT's step keys, step the CW frequency through Band 3 from 13.5 to 19.9 GHz and adjust A26R49 (X3) for the most horizontal line across Band 3.

    If the DUT is an HP 8341B, proceed to LEVELED BIAS, BANDS 2 THROUGH 4

29. On the DUT, press **[CW] [2] [0] [GHz].** Using the DUT's step keys, step the CW frequency through Band 4 from 20.0 to 26.4 GHz and adjust A26R51 (X4) for the most horizontal line across Band 4.

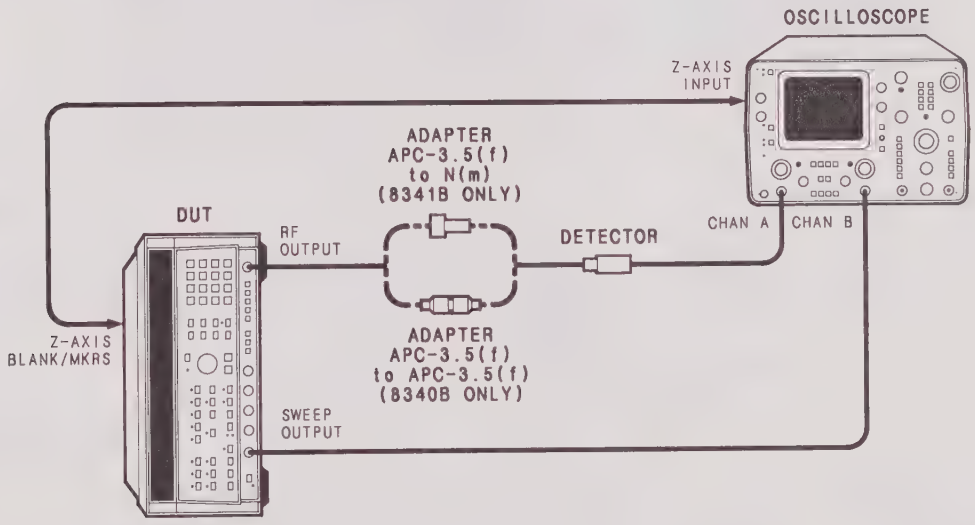


Figure 5-57. Leveled Bias Adjustment Setup, Bands 2 through 4

LEVELED BIAS, BANDS 2 THROUGH 4

30. Remove the oscilloscope probes and connect the detector and oscilloscope as shown in Figure 5-57. On the DUT, press **[INSTR PRESET] [RECALL] [2]**. Press **[SWEEP TIME] [AUTO]**. Press **[SHIFT] [PWR SWP] [-] [2] [0] [dBm]**.

31. Set the oscilloscope for A vs B mode and set the oscilloscope's horizontal sensitivity (CHAN B) for 1 V/Div and vertical sensitivity (CHAN A) for 0.005 V/Div. Adjust the oscilloscope's position controls to display the swept RF output.

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

32. Using the DUT's front panel rotary knob (RPG), vary the ALC level from −20 dBm to +20 dBm. Look for squegging as shown in Figure 5-58. As the power level is increased, you will need to decrease the vertical sensitivity (CHAN A) and adjust the vertical positions on the oscilloscope. If any squegging occurs, examine the ENTRY DISPLAY to determine the requested ALC level. If the ALC level is at or below the maximum specified leveled power, adjust A24R5 (X2C) counter-clockwise to eliminate the squegging. If the ALC level is above maximum leveled power, what you are seeing is probably the RF output going unleveled and cannot be adjusted out.

NOTE

Squegging on the oscilloscope display may appear as shown in Figure 5-58 (power spikes and oscillations) or it may appear as power spikes without the oscillations. In either case the appropriate adjustment should be made to eliminate the squegging.

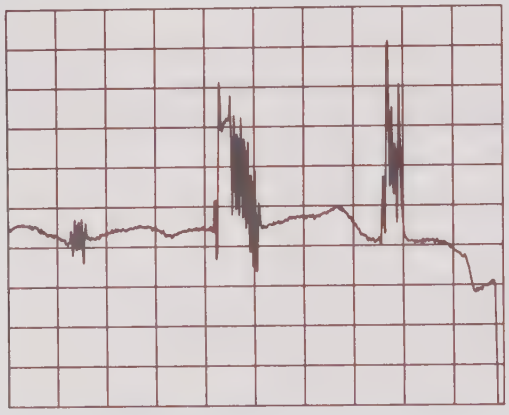


Figure 5-58. Oscilloscope Display with Squegging Present

33. On the DUT, press **[START FREQ] [1] [3] [.] [5] [GHz] [STOP FREQ] [2] [0] [GHz] [SHIFT] [PWR SWP] [-] [2] [0] [dBm]**. Set the oscilloscope's vertical sensitivity to 0.005 V/Div. Vary the ALC level as in step 32 and check for squegging. If any squegging occurs, examine the ENTRY DISPLAY to determine the requested ALC level. If the ALC level is at or below the maximum specified leveled power, adjust A24R8 (X3C) counter-clockwise to eliminate the squegging. If the ALC level is above maximum leveled power, what you are seeing is probably the RF output going unleveled and cannot be adjusted out.

    If the DUT is an HP 8341B, proceed to step 35.

34. On the DUT, press **[START FREQ] [2] [0] [GHz] [STOP FREQ] [2] [6] [.] [5] [GHz] [SHIFT] [PWR SWP] [-] [2] [0] [dBm]**. Set the oscilloscope's vertical sensitivity to 0.005 V/Div. Vary the ALC level as in step 32 and check for squegging. If any squegging occurs, examine the ENTRY DISPLAY to determine the requested ALC level. If the ALC level is at or below the maximum specified leveled power, adjust A24R11 (X4C) counter-clockwise to eliminate the squegging. If the ALC level is above maximum leveled power, what you are seeing is probably the RF output going unleveled and cannot be adjusted out.

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

35. On the DUT, press **[SHIFT] [PWR SWP] [0] [dBm]** to set the ALC level at 0 dBm and then press **[START FREQ] [1] [4] [GHz]**. Slowly rotate the DUT's RPG clockwise while watching the oscilloscope display for squegging. If any squegging is seen, stop at the start frequency at which it occurs. If the squegging occurs in Band 3 (13.5 to 20 GHz), adjust A24R8 (X3C) counter-clockwise until the squegging is gone. If the squegging occurs in Band 4 (20 to 26.5 GHz), adjust A24R11 (X4C) counter-clockwise until the squegging is gone.

36. Repeat step 35 for ALC levels of −5 dBm, −10 dBm and −15 dBm.

NOTE

If adjustments of the Cal Constants were made in this procedure, the Cal Constants data stored in the "working memory" should be copied into the "protected memory" by pressing [SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz]. Wait for "CALIBRATION RESTORED" to be displayed in the ENTRY DISPLAY, then press [INSTR PRESET].

LEVELED SQUEGGING TEST USING A SPECTRUM ANALYZER

Description

The DUT's RF output signal is down converted using a Local Oscillator (LO) and a mixer. The IF output of the mixer is fed to a spectrum analyzer. Any squegging of the DUT will appear as a spurious response on the IF signal.

This test should be performed after SYTM tracking and delay, and SRD unleveled bias adjustments.

Equipment

Synthesized Sweeper	HP 8340B Option 001
10 dB Attenuator	HP 8493C Option 010
Mixer	HP P/N 0955-0307
Spectrum Analyzer	HP 8566B
Adapters:	
APC 3.5 (f) To Type N (m) (required if DUT is an HP 8341B)	HP P/N 1250-1744
APC 3.5 (f) to APC 3.5 (f) (required if DUT is an HP 8340B)	HP P/N 5061-5311

37. Connect equipment as shown in Figure 5-59. Connect the mixer LO input port directly to the LO RF output connector to obtain maximum mixer LO input level. Allow at least 30 minutes warm up time.

38. Press the LO **[INSTR PRESET]**. Press **[START FREQ]** and enter **[6] [.] [4] [GHz]**. Press **[STOP FREQ]** and enter **[1] [2] [.] [9] [GHz]**. Press **[POWER LEVEL]** and enter **[1] [0] [dBm]**. Press **[SHIFT] [CF]** and enter **[1] [0] [0] [MHz]** for a step size of 100 MHz. Press **[MANUAL]** SWEEP and enter **[6] [.] [4] [GHz]** to set the LO to CW at 6.4 GHz.

39. On the DUT, press **[INSTR PRESET]**. Press **[START FREQ]** and enter **[7] [GHz]**. Press **[STOP FREQ]** and enter **[1] [3] [.]] [5] [GHz]**. Press **[POWER LEVEL]** and using the front panel rotary knob, adjust for maximum leveled power (just before the UNLEVELED light comes on). Press **[SHIFT] [CF]** and enter **[1] [0] [0] [MHz]** for a step size of 100 MHz. Press **[MANUAL]** SWEEP and enter **[7] [GHz]**. The mixer IF frequency is now 600 MHz.

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

40. Set the spectrum analyzer for FULL SPAN of 0-2.5 GHz. Set RES BW for 300 kHz. Set VIDEO BW for 100 kHz. Set START FREQ to 590 MHz. Set STOP FREQ to 800 MHz. Set REFERENCE LEVEL to −10 dBm. Set ATTEN to 0 dB. Press HOLD to retain these settings. The 600 MHz IF signal should be near the left side of the spectrum analyzer CRT.

41. Using the [▲] key on both the DUT and the LO, step through Band 2 observing the spectrum analyzer display at each step. There may be signals due to mixing products, and/or squegging. Mixing products will appear as low level signals. Squegging signals will appear as a higher amplitude signal as shown in Figure 5-60. If squegging occurs, adjust A24R5 (X2C) slightly CCW to eliminate the squegging. Note, if the control is adjusted and there is no effect on the signal, the signal is probably a mixing product.

NOTE

Test for squegging at power levels from maximum leveled power to −20 dBm in 5 dB increments.

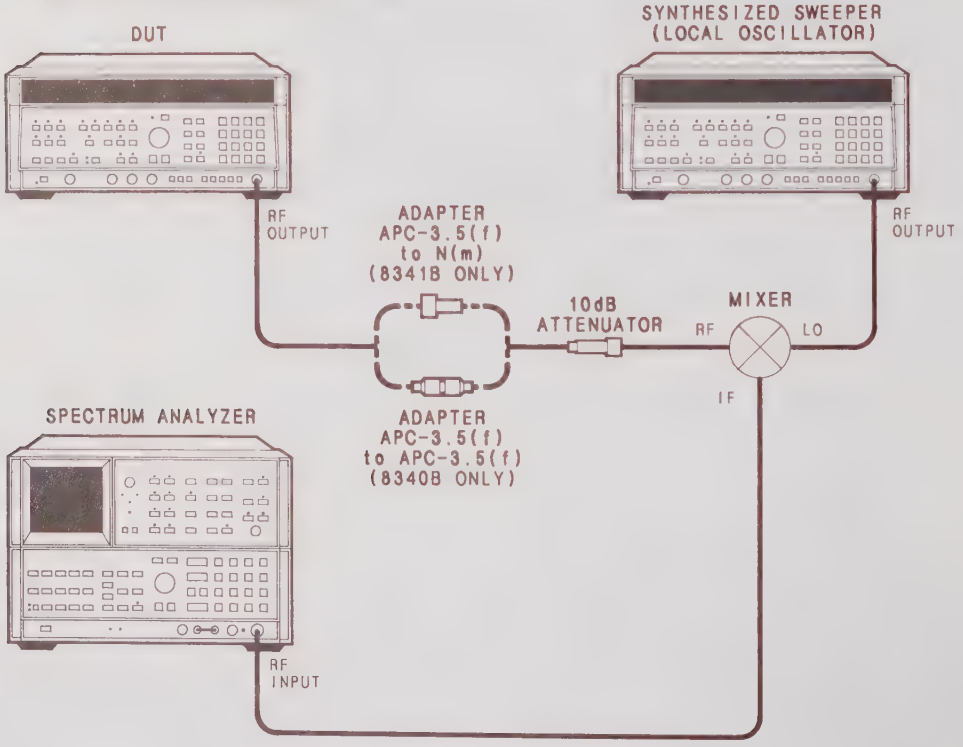


Figure 5-59. Leveled Squegging Test Setup

42. On the DUT, press **[SHIFT] [PWR SWP]** and enter the maximum ALC power level that will be a 5 dB increment below max leveled power (i.e., 15, 10, 5). Repeat step 41 at this power level. Enter the next 5 dB increment and repeat step 41 until the test for squegging has been performed from maximum leveled power to −20 dBm.

43. For Band 3, press the LO **[START FREQ]** and enter **[1] [2] [.] [9] [GHz]**. Press **[STOP FREQ]** and enter **[1] [9] [.] [4] [GHz]**. Press **[MANUAL]** and enter **[1] [2] [.] [9] [GHz]**.

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

44. On the DUT, press **[START FREQ]** and enter **[1] [3] [.] [5] [GHz]**. Press **[STOP FREQ]** and enter **[2] [0] [GHz]**. Press **[POWER LEVEL]** and using the front panel rotary knob, adjust for maximum leveled power. Press **[MANUAL]** and enter **[1] [3] [.] [5] [GHz]**.

45. Using the step keys as described in step 41, step through Band 3. If squegging occurs, adjust A24R8 (X3C) slightly CCW to eliminate the squegging.

NOTE

Test for squegging at power levels from maximum leveled power to −20 dBm in 5 dB increments.

46. On the DUT, press **[SHIFT] [PWR SWP]** and enter the maximum ALC power level that will be a 5 dB increment below max leveled power (i.e., 10,5). Repeat step 45 at this power level. Enter the next 5 dB increment and repeat step 45 until the test for squegging has been performed from maximum leveled power to −20 dBm. This completes Leveled RF Output Adjustments for an HP 8341B. If testing an HP 8340B, continue with step 47.

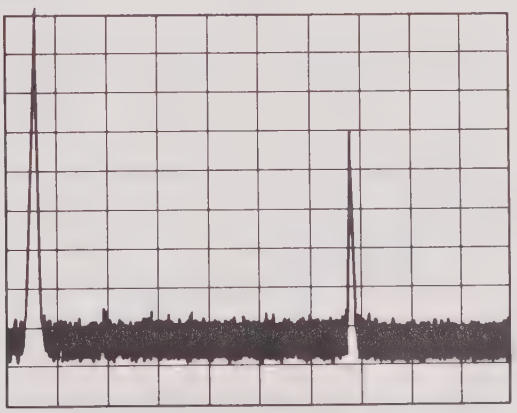


Figure 5-60. Squegging Displayed on Spectrum Analyzer

47. For Band 4, press the LO **[START FREQ]** and enter **[1] [9] [.] [4] [GHz]**. Press **[STOP FREQ]** and enter **[2] [5] [.] [9] [GHz]**. Press **[MANUAL]** and enter **[1] [9] [.] [4] [GHz]**.

48. Press the DUT's **[START FREQ]** and enter **[2] [0] [GHz]**. Press **[STOP FREQ]** and enter **[2] [6] [.] [5] [GHz]**. Press **[CONT]** and **[POWER LEVEL]**. Adjust the DUT front panel rotary knob for maximum leveled power. Press **[MANUAL]** and enter **[2] [0] [GHz]**.

5-16. LEVELED RF OUTPUT ADJUSTMENTS (Cont'd)

49. Use the step keys to step through Band 4. If squegging occurs, adjust A24R11 (X4C) slightly CCW to eliminate the squegging.

NOTE

Test for squegging at power levels from maximum leveled power to −20 dBm in 5 dB increments.

50. Press the DUT's **[SHIFT] [PWR SWP]** and enter the maximum ALC power level that will be a 5 dB increment below max leveled power (i.e., 5, 0, −5). Repeat step 49 at this power level. Enter the next 5 dB increment and repeat step 49 until the test for squegging has been performed from maximum leveled power to −20 dBm.

5-17. RF OUTPUT POWER FLATNESS ADJUSTMENT

Reference

Performance Test: Maximum Leveled Output Power and Accuracy
Service Section: RF Section

Description

This procedure adjusts the DUT's RF output power flatness across the entire frequency range. Flatness is adjusted by using an oscilloscope to view the power meter's recorder output while sweeping. Flatness corrections are made by modifying the appropriate Calibration Constants.

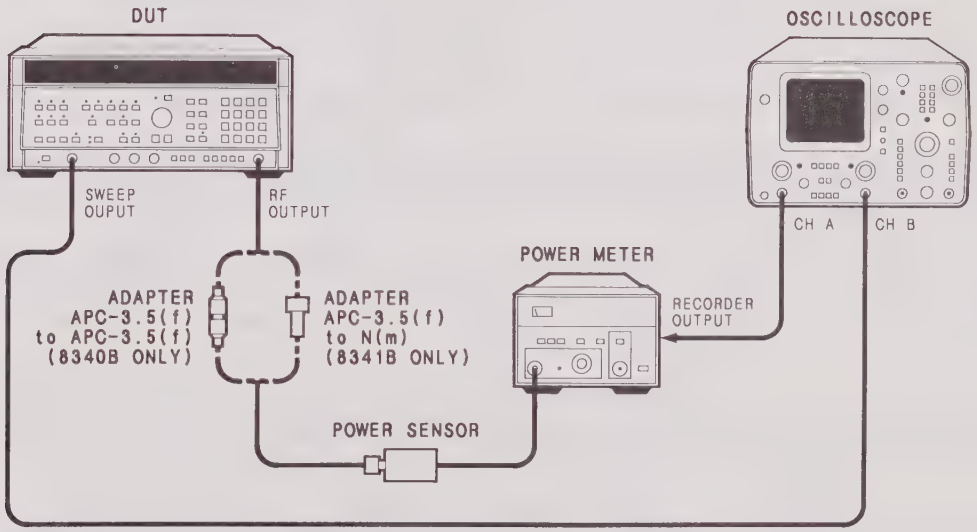


Figure 5-61. RF Output Power Flatness Setup

Equipment

Oscilloscope	HP 1741A
Power Meter	HP 436A
Power Sensor	HP 8485A
Power Sensor	HP 8481A
Adapters:	
APC 3.5 (f) to APC 3.5 (f) (required for HP 8340B to HP 8485A connection)	HP P/N 5061-5311
APC 3.5 (f) — Type N (m) (required for HP 8341B to HP 8485A connection)	HP P/N 1250-1744
APC 3.5 (f) to Type N (f) (required for HP 8340B to HP 8481A connection)	HP P/N 1250-1745

5-17. RF OUTPUT POWER FLATNESS ADJUSTMENT (Cont'd)

Procedure

1. Calculate a correction factor for the HP 8485A Power Sensor as follows:

   Find the CAL FACTOR end points (0.05 GHz and the maximum DUT RF Output frequency) by either using a calculator to find the best straight line approximation to the CAL FACTOR curve in percent or by using a straight edge for the best straight line approximation on the CAL FACTOR curve located on the body of the power sensor.

   Convert both end points to dB using the following equation:

   Endpoint (dB) = −10log(endpoint(%)/100)

   Calculate the slope as follows:

   HP 8340B:

   Slope (dB/GHz) = [26.5 GHz Endpoint (dB) − 0.05 GHz Endpoint (dB)]/26.45

   HP 8341B:

   Slope (dB/GHz) = [20 GHz Endpoint (dB) − 0.05 GHz Endpoint (dB)]/19.95

2. Connect the HP 8485A power sensor to the power meter and then turn the DUT's and the power sensor's LINE switches ON. Connect the oscilloscope as shown in Figure 5-61. Allow 30 minutes for the equipment to warm up.

3. Calibrate and zero the power meter. On the DUT, press **[INSTR PRESET] [CW] [4] [.] [5] [GHz]** and then **[RF]** to turn the RF off. Zero the power meter. To ensure that the power meter is properly zeroed, select WATT mode, and press the ZERO button until the power meter indicates < 0.02 on the most sensitive range. Select the dBm MODE on the power meter.

4. On the DUT, press **[INSTR PRESET] [START] [2] [.] [4] [GHz]**. Press **[POWER LEVEL] [0] [dBm] [SWEEP TIME] [5] [sec]**. Press **[SLOPE]**, enter the slope calculated in step 1, and terminate the entry by pressing **[dBm]**. Save this instrument state by pressing **[SAVE] [1]**.

5. Set the oscilloscope to A vs B. Set the horizontal sensitivity (CHAN B) for 1 V/Div and the vertical sensitivity (CHAN A) for 0.1 V/Div. Adjust the oscilloscope's vertical position control to center the trace on the oscilloscope. Adjust the horizontal position control to display the entire trace.

6. On the DUT, press **[INSTR PRESET] [CW] [1] [4] [GHz] [SHIFT] [POWER LEVEL] [.] [0] [5] [dBm] [POWER LEVEL] [-] [1] [dBm]**. Press RANGE HOLD on the power meter and set the CAL FACTOR % dial for the 14 GHz CAL FACTOR indication on the power sensor.

7. Using the DUT's front panel rotary knob (RPG), increase the power level until the power meter indicates 0 dBm. The output power sensitivity on the DUT is 0.05 dBm so adjust the power level for the closest reading to 0 dBm if you cannot adjust for exactly 0 dBm.

8. Adjust the oscilloscope's CHAN A position control to place the dot on the center horizontal graticule. Determine the dB/Div sensitivity of the oscilloscope by rotating the DUT's rotary knob until the dot is 1 major graticule above the center graticule. Determine the sensitivity by reading the power level on the power meter. Repeat this process and determine the sensitivity for the second major graticule above the center graticule and the two major divisions below the center graticule. Once the oscilloscope is calibrated in this manner, you can use the oscilloscope's display to determine the power flatness of the trace. The scope should now be set up for 2.4 GHz/Div (X-Axis) and approximately 0.4 dB/Div (Y-Axis).

5-17. RF OUTPUT POWER FLATNESS ADJUSTMENT (Cont'd)

9. Set the power meter's CAL FACTOR % dial to 100%. Press **[RECALL] [1]** on the DUT. Set the oscilloscope for maximum PERSISTENCE and minimum BRIGHTNESS. On the DUT, Press **[SHIFT] [GHz] [1] [4] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]** to access Cal Constant 14.

NOTE

Refer to Figure 5-62 to determine the effect the following adjustments have on the flatness of the RF output.

NOTE

The bandcross points seen on the oscilloscope can be used as a frequency reference for the following adjustments. The frequency of the bandcross points are, from left to right, 7.0, 13.5, and in the case of the HP 8340B, 20.0 GHz. The bandcross points are the points at which the sweep pauses and the power drops to a minimum for an instant.

Adjust Cal Constant 14 for the flattest trace from 2.4 to 9 GHz

Press the DUT's **[▲]** step key to access Cal Constant 15 and adjust Cal Constant 15 and A27R4 (BK PT1) for the flattest trace from 9 to 20 GHz.

If adjusting an HP 8340B, press the DUT's **[▲]** step key to access Cal Constant 16. Adjust Cal Constant 16 and A27R8 (BK PT2) for the flattest trace from 20 to 26.5 GHz.

Repeat these adjustments until the flattest trace is obtained from 2.4 to the maximum DUT RF Output frequency.

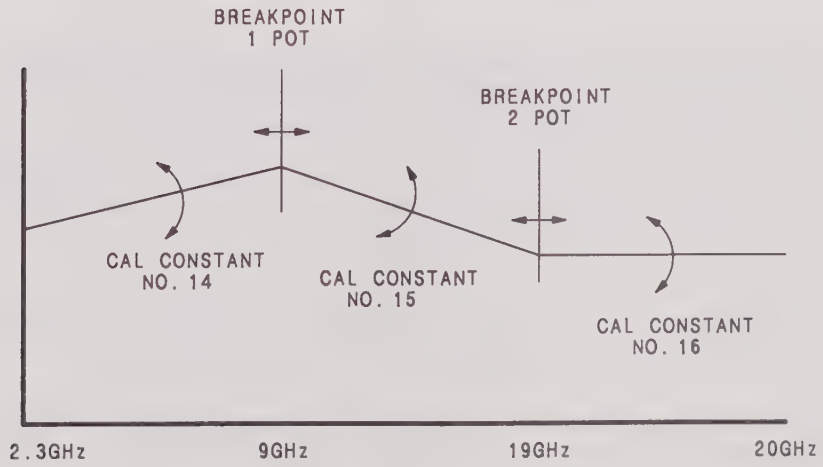


Figure 5-62. Relationship of Flatness Adjustments Diagram

5-17. RF OUTPUT POWER FLATNESS ADJUSTMENT (Cont'd)

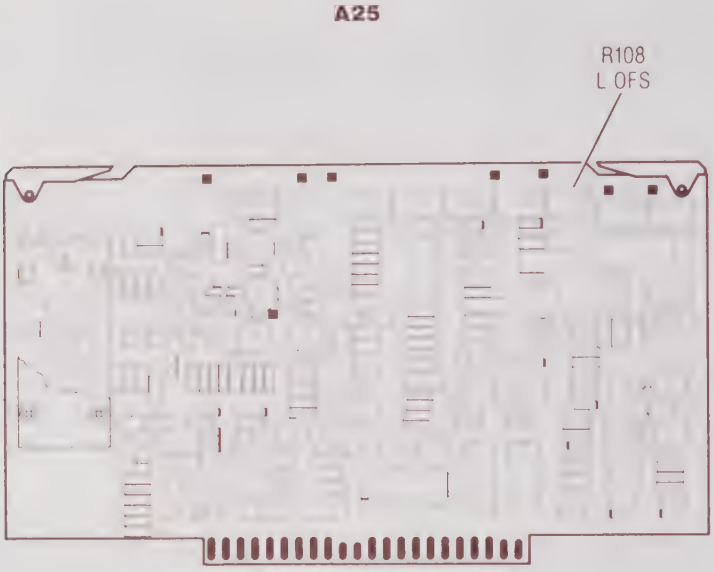


Figure 5-63. Flatness Adjustment Location

10. Set the oscilloscope's PERSISTENCE to minimum. On the DUT, press **[MANUAL] [2] [.] [4] [GHz]** and **[SLOPE]** to turn the slope off. Adjust the CAL FACTOR % dial on the power meter for the 2.4 GHz CAL FACTOR indication on the power sensor.

11. On the DUT, press **[SHIFT] [GHz] [4] [4] [Hz] [SHIFT] [ENTRY OFF]** to access Cal Constant 44. On the power meter, press RANGE HOLD to turn it off. Adjust Cal Constant 44 for a 0 dBm indication on the power meter.

12. Turn the power meter off and disconnect the HP 8485A power sensor. Connect the HP 8481A power sensor and turn the power meter on. Allow 15 minutes for the sensor to stabilize and then zero and calibrate the power meter.

13. On the DUT, press **[INSTR PRESET] [START FREQ] [1] [0] [MHz] [STOP FREQ] [2] [.] [4] [GHz] [MANUAL] [1] [0] [0] [MHz] [POWER LEVEL] [0] [dBm]**. Set the power meter's CAL FACTOR % dial for the 100 MHz CAL FACTOR indication on the power sensor.

14. Connect the power sensor to the DUT's RF output and then press **[RF]** on the DUT to turn the RF off. Zero the power meter. To ensure that the power meter is properly zeroed, select WATT mode, and press the ZERO button until the power meter indicates < 0.02 on the most sensitive range. Select the dBm MODE on the power meter.

15. Press **[RF]** on the DUT to turn the RF on. Allow a few seconds for the power meter to stabilize and then note the power meter indication. This power level will be P3 in the following equation.

16. Press **[MANUAL] [2] [.] [4] [GHz]** on the DUT. Set the power meter's CAL FACTOR % dial for the 2.4 GHz CAL FACTOR indication on the power sensor. Note the power meter indication. This power level will be P4 in the following equation.

    Calculate the value of P using the following equation:

    $$P = (1.044 \times P3) - (0.044 \times P4)$$

5-17. RF OUTPUT POWER FLATNESS ADJUSTMENT (Cont'd)

17. On the DUT, press **[SHIFT] [GHz] [1] [3] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]** to access Cal Constant 13. Adjust Cal Constant 13 for a power meter indication of P. Adjust A25R108 (LOFS) (Figure 5-63) for a 0 dBm indication on the power meter.

AM OFFSET

18. On the DUT, press **[CW] [4] [.] [5] [GHz] [POWER LEVEL] [0] [dBm].** Set the power meter's CAL FACTOR % dial for the 4.5 GHz CAL FACTOR indication on the power sensor. Adjust the DUT's rotary knob for a 0 dBm indication on the power meter.

19. On the DUT, press **[SHIFT] [GHz] [4] [3] [Hz] [SHIFT] [ENTRY OFF]** to access Cal Constant 43. Adjust Cal Constant 43 for no more than 0.05 dB change in the power meter indication when turning **[AM]** on and off.

ADC CAL CONSTANTS

20. On the DUT, press **[SHIFT] [PWR SWP] [0] [dBm]** to decouple the RF attenuator and the ALC and to set the ALC at 0 dBm. The RF attenuator should also be at 0 dB. If it is not, use the **[▲]** step key to set it to 0. Press **[AM]** to turn the AM on.

21. On the DUT, press **[SHIFT] [GHz] [4] [2] [Hz] [SHIFT] [ENTRY OFF]** to access Cal Constant 42. Adjust Cal Constant 42 so the DUT's POWER dBm display shows 0.00 dBm.

22. On the DUT, press **[SHIFT] [PWR SWP] [-] [2] [0] [dBm]** to set the ALC level to −20 dBm. Press **[SHIFT] [GHz] [4] [0] [Hz] [SHIFT] [ENTRY OFF]** to access Cal Constant 40 and adjust Cal Constant 40 so the DUT's POWER dBm display shows −20.00 dBm.

23. On the DUT, press **[CW] [1] [.] [5] [GHz]**. Press **[SHIFT] [GHz] [3] [9] [Hz]** to access Cal Constant 39 and adjust Cal Constant 39 so the DUT's POWER dBm display shows −20.00 dBm.

NOTE

If adjustments of the Cal Constants were made in this procedure, the Cal Constants data stored in the "working memory" should be copied into the "protected memory" by pressing [SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz]. Wait for "CALIBRATION RESTORED" to be displayed in the ENTRY DISPLAY, then press [INSTR PRESET].

5-18. PULSE ADJUSTMENTS

Reference

Performance Test: Pulse Modulation Rise, Fall, and Delta Time; Pulse Modulation Accuracy; and Pulse Modulation Video Feedthrough

Service Section: RF Section

Description

The detector sample-and-hold balance is adjusted for best continuity across the trailing edge of the pulse waveform. The timing is adjusted for maximum negative level.

The integrator gate balance is set for the flattest pulse envelope.

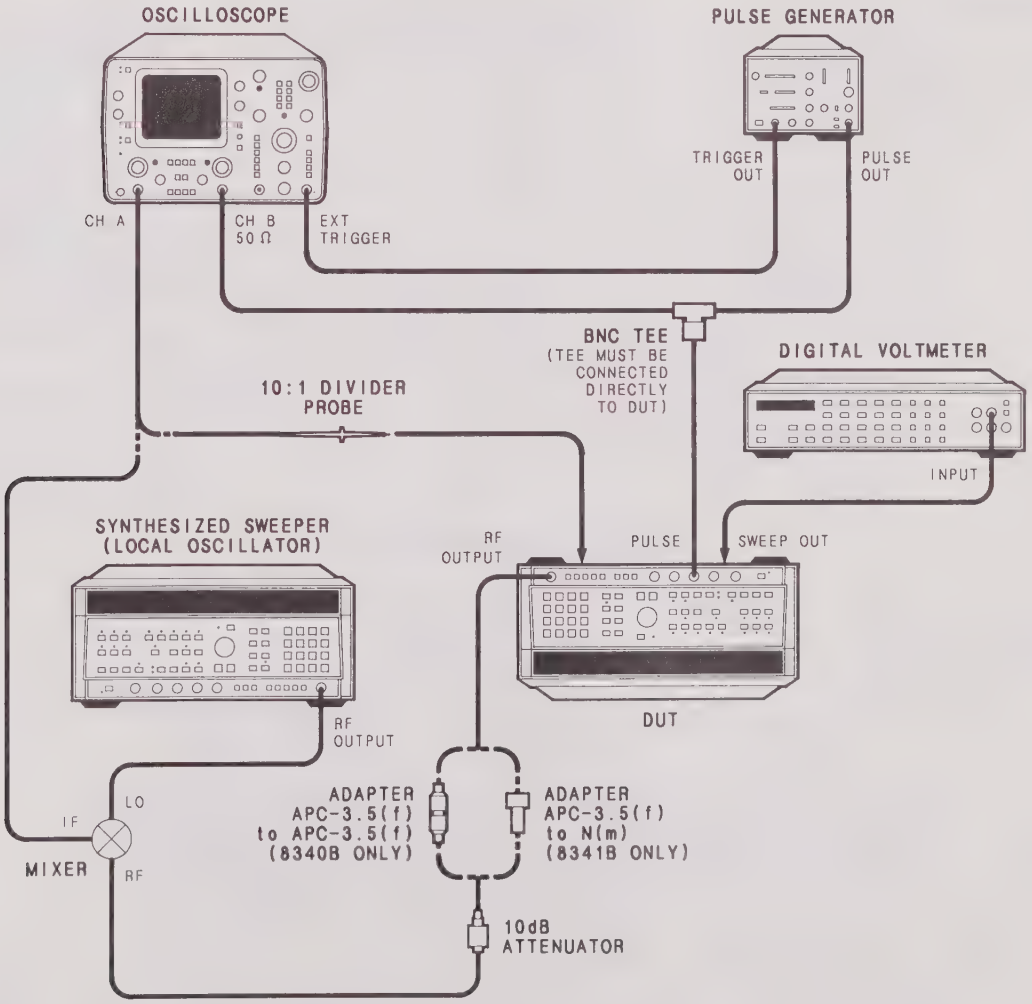


Figure 5-64. Pulse Adjustment Setup

5-18. PULSE ADJUSTMENTS (Cont'd)

NOTE

The following adjustments are required if any of the following four assemblies have been replaced or if any of the controls listed after each assembly have been adjusted or replaced.

A11 High Band Detector (Bands 1 - 4)
A21 Pulse Modulator Assembly, A21R45 (ON DELAY-INT), A21R47 (OFF DELAY)
A25 ALC Detector Assembly, A25R58 (BAL)
A26 Linear Modulator Assembly, A26R7 (BAL)

Equipment

Synthesized Sweeper	HP 8340B Opt. 001
Pulse Generator	HP 8012B
Oscilloscope	HP 1741A
10:1 Divider Probe	HP 10004D
Mixer	HP P/N 0955-0307
Digital Voltmeter	HP 3456A
Amplifier	HP 8447F
Low Pass Filter	HP P/N 9135-0260
10 dB Attenuator	HP 8493C Option 010
Adapters:	
APC 3.5 (f) to APC 3.5 (f) (required if DUT is an HP 8340B)	HP P/N 5061-5311
APC 3.5 (f) to Type-N (m) (required if DUT is an HP 8341B)	HP P/N 1250-1744
BNC (f) to Dual Banana	HP P/N 1251-2277
BNC Tee	HP P/N 1250-0781

Procedure

If the DUT is equipped with Option 006, Delete Pulse Modulation, proceed directly to step 16.

DETECTOR SAMPLE AND HOLD BALANCE ADJUSTMENT

1. Connect equipment as shown in Figure 5-64. Allow at least 30 minutes warmup.

NOTE

The A21, A25, and A26 PC boards must not be placed on extender boards in this adjustment procedure. Also, the cables connected to detectors A11 and A12 are especially designed for low capacitance and only these cables may be used during adjustment procedures.

2. Set the oscilloscope as follows:

DISPLAY	CHOP
MODE	MAIN
MAG X5	ON
CH A	0.005 V/Div AC COUPLED
CH B	5 V/Div 50 Ohms
TIME/Div	2 µsec

Connect CH A probe to A26TP2 (DET)

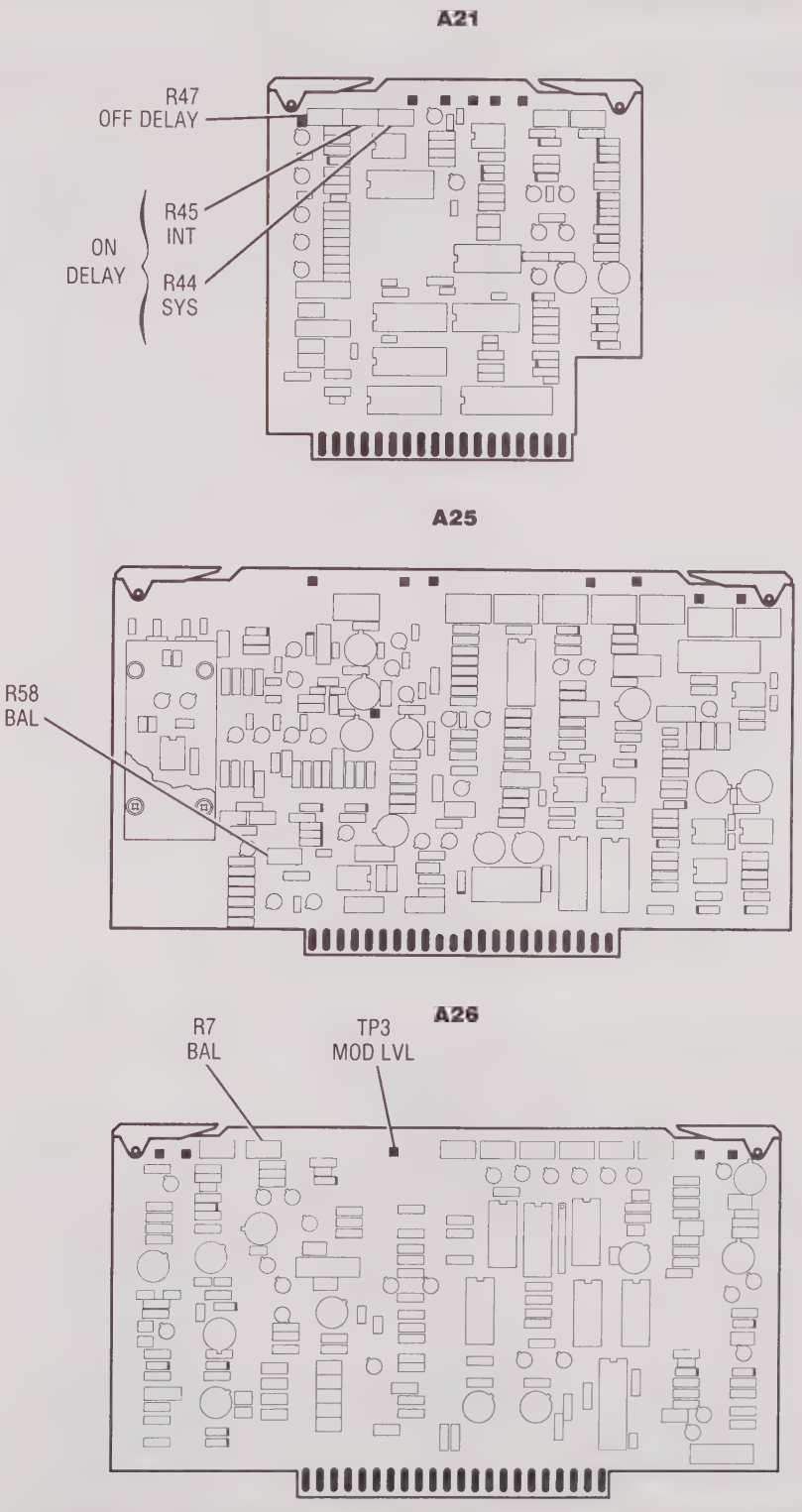


Figure 5-65. Pulse Adjustments Location

5-18. PULSE ADJUSTMENTS (Cont'd)

3. Set the pulse generator for a pulse width of 4 microseconds, a pulse period of 10 microseconds, and amplitude +3 Volts high and 0 Volts low. Remember that CHAN B is inverted and X5 MAG is on.

4. On the DUT, press **[INSTR PRESET]**. Press **[PULSE]** ON. Press **[CW]** and enter **[5] [GHz]**. Press **[SHIFT] [PWR SWP]** and enter **[0] [dBm]**. Use the step keys to step in 10 dB RF attenuation. If the DUT does not include an RF attenuator, connect a 10 dB pad to the RF output. Set A21R45 (ON DELAY-INT), A21R47 (OFF DELAY), and A21R44 (ON DELAY-SYS) fully counterclockwise. (See Figure 5-65.)

   Check that the DUT is leveled (the UNLEVELED light is not lit).

5. Set the oscilloscope to 1 usec/Div. the CH A trace should be similar to Figure 5-66.

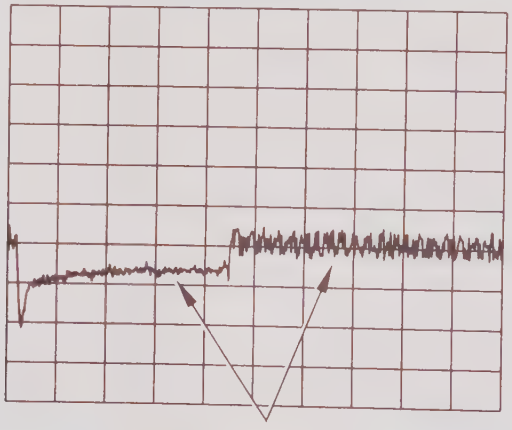


Figure 5-66. Typical A26TP2 (DET) Pulse Waveform.

6. Adjust A25R58 (BAL) control for best continuity (flat line) across the pulse trailing edge. (NOTE: A25 must not be on an extender board when viewing trace.).

SAMPLE AND HOLD TIMING ADJUSTMENT

7. Set the pulse generator for a pulse width of 120 nanoseconds. On the DUT, press **[SHIFT] [PWR SWP]** and enter **[−] [1] [0] [dBm]**. Then press **[SHIFT] [SLOPE]** and use the **[STEP]** keys to set attenuator to −10 dB.

8. Connect the DVM to A26TP3 (MOD LVL). Adjust A21R45 (ON DELAY-INT) and A21R47 (OFF DELAY) for the most negative reading.

9. Set the DUT controls as shown below:

   a Press **[SHIFT] [PWR SWP]** and use **[STEP]** keys to set attenuator to −10 dB.
   b. Use keys to enter **[0] [dBm]**.
   c. Press **[CW]** and enter **[5] [GHz]**.

10. Set the oscilloscope to 0.2 usec/DIV and adjust the Pulse Generator to a 1 usec pulse.

5-18. PULSE ADJUSTMENTS (Cont'd)

11. Connect the output IF port of the mixer to CH A of oscilloscope and set oscilloscope to 50 Ohm input and .005 V/DIV.

12. At the Local Oscillator, make settings as follows:

    a. Press **[INSTR PRESET] [CW]** and enter **[4] [.] [9] [5] [GHz]**.
    b. Press **[POWER LEVEL]** and enter **[1] [0] [dBm]**.

13. Turn pulse ON and then OFF alternately by pressing **[PULSE]** pushbutton. Adjust A25R58 BAL control so that the peak-to-peak amplitude of the envelope disiplayed on the oscilloscope is the same value with pulse on and pulse off.

INTEGRATOR GATE BALANCE ADJUSTMENT

14. Set the pulse generator for a pulse width of 5 microseconds and a pulse period of 20 microseconds. Set oscilloscope to 1 μsec/Div.

15. On the DUT, press **[PULSE] [SHIFT] [AM]** and adjust A26R7 BAL for the flattest pulse envelope on the CH A display.

    Press **[AM]** OFF and the pulse envelope should be flatter. Proceed to step 23.

SLOW PULSE MODULATION, COURSE ADJUSTMENT

NOTE

Steps 16 through 22 should only be performed for HP 8340Bs that are equipped with 006, Delete Pulse Modulation. Steps 23 through 28 should be performed for all DUTs.

16. Connect the instruments as shown in Figure 5-67.

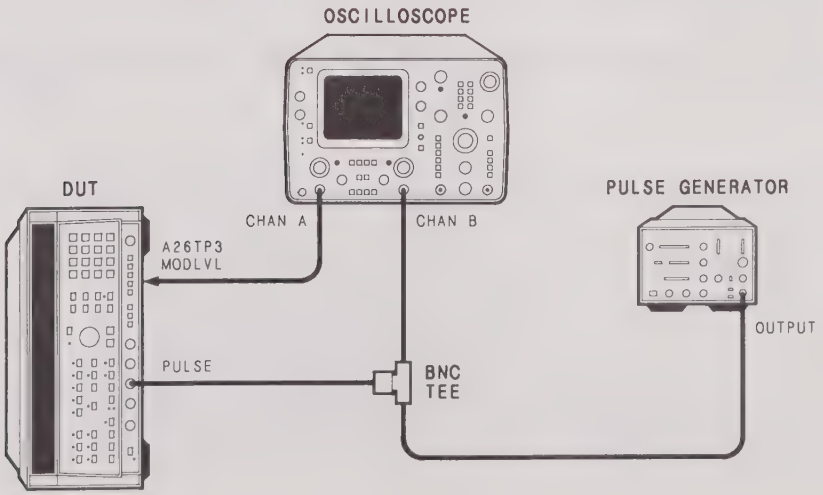


Figure 5-67. Pulse Modulation Rise and Fall Time Test Setup

5-18. PULSE ADJUSTMENTS (Cont'd)

17. Set up the pulse generator for a 25 kHz, 5 Vpk (10 Vp-p), square wave.

18. Set the oscilloscope as follows:

DISPLAY	CHANNEL A
CHAN A	.005 V/Div (AC)
CHAN B	2.0 V/Div (50 Ohm)
TRIGGER	CHAN B
TIME/Div	5 µsec

19. On the HP 8340B (Option 006), press **[CW] [1] [GHz] [POWER LEVEL] [5] [dBm] [SHIFT] [AM] [SHIFT] [PULSE]**.

20. Adjust A26R7 (BAL) and A25R58 (BAL) full clockwise. The oscilloscope display should look similar to Figure 5-68, waveform a.

21. Adjust A25R58 (BAL) for an oscilloscope display as shown in Figure 5-68, waveform b.

22. Adjust A26R7 (BAL) for an oscilloscope display as shown in Figure 5-68, waveform c.

SLOW PULSE MODULATION FINE ADJUSTMENT

23. Connect the equipment as shown in Figure 5-69. Connect the mixer directly to the local oscillator's RF output to obtain the maximum LO drive to the mixer. Connect the BNC tee directly to the DUT's PULSE connector. Allow 30 minutes for the instruments to warm up.

24. Set the oscilloscope as follows:

DISPLAY	CHANNEL B
CHAN A	0.1 V/Div, 50 Ohms
CHAN B	5 V/Div, 50 Ohms
TRIGGER	INT., CHAN B
TIME/Div	5 usec

25. Set up the pulse generator for a 25 kHz (8 divisions on the oscilloscope), 5V peak (10 V p-p) square wave. The damage level for the DUT's PULSE input is +12V −20V so do not overdrive the input.

26. On the DUT, press **[INSTR PRESET] [CW] [2] [GHz] [POWER LEVEL] [0] [dBm] [SHIFT] [PULSE]**.

NOTE

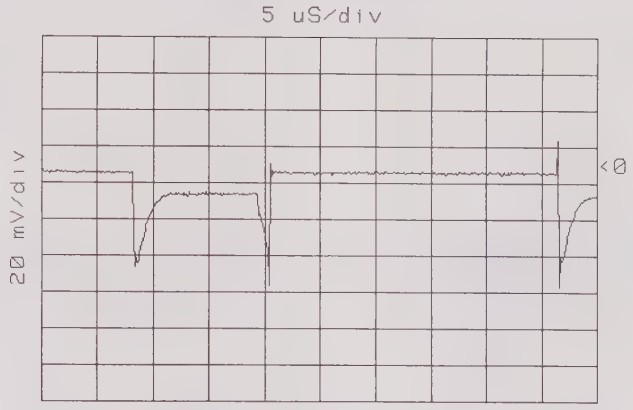
For best accuracy in this test, the LO drive to the mixer should be > +4 dBm.

27. On the LO, press **[INSTR PRESET] [CW] [1] [.] [9] [5] [GHz] [POWER] [LEVEL] [1] [0] [dBm].**

28. Press DISPLAY A on the oscilloscope. Adjust A21R30 (LSYM) so that the 50% points on the pulse envelope cover four vertical graticules on the oscilloscope (50% duty cycle).

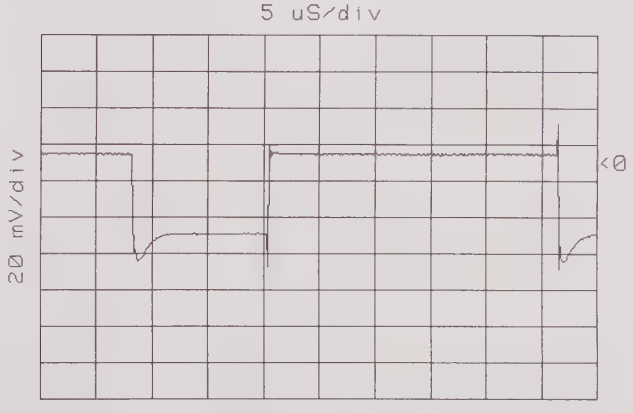
29. On the DUT, press **[CW] [3] [GHz].** On the LO, press **[CW] [2] [.] [9] [5] [GHz]**. Adjust A21R29 (HSYM) so that the 50% points on the pulse envelope cover four vertical graticules on the oscilloscope (50% duty cycle).

VIEW A



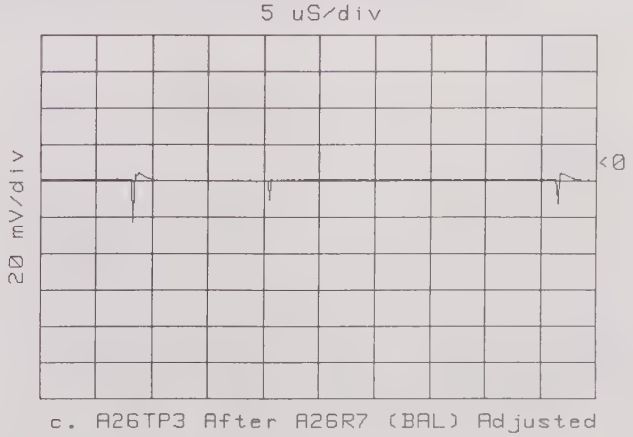
a. A25R58 (BAL) and A26R7 (BAL)
Preset Full Clockwise

VIEW B



b. A26TP3 After A25R58 (BAL) Adjusted

VIEW C



c. A26TP3 After A26R7 (BAL) Adjusted

Figure 5-68. A26TP3 Typical Waveforms

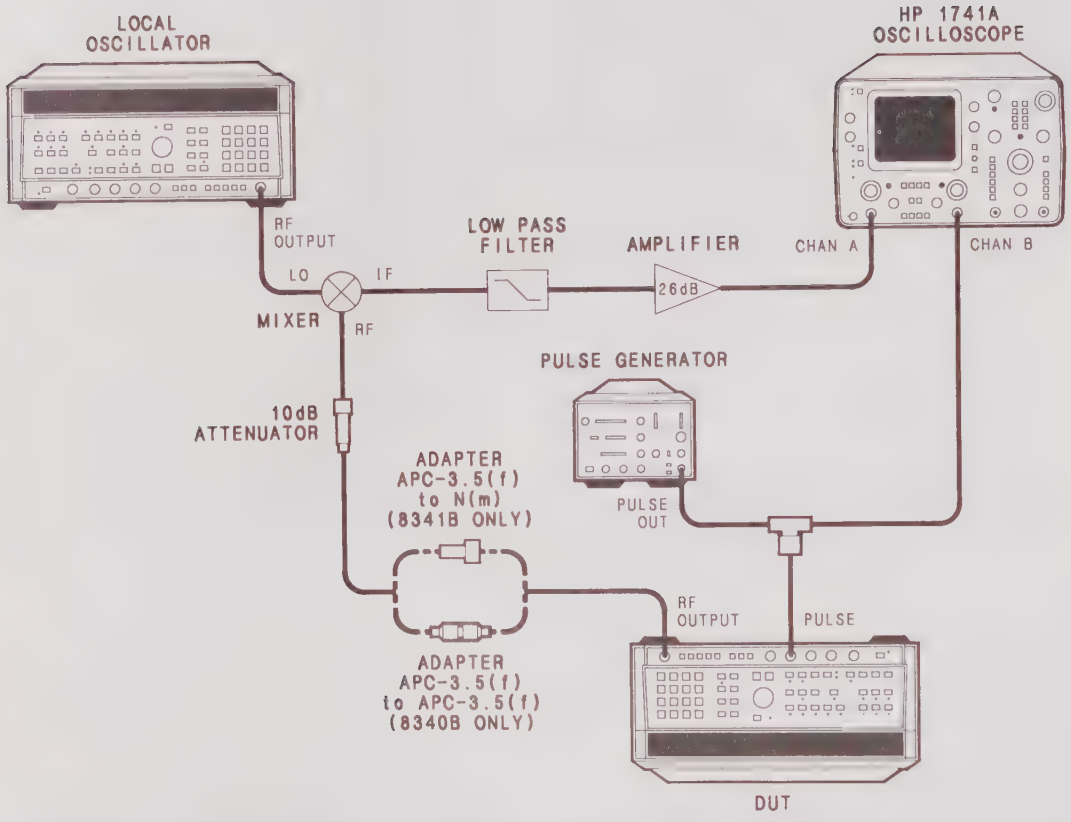


Figure 5-69. Slow Pulse Modulation Fine Adjust Setup

5-19. EXTERNAL MODULE LEVELING ADJUSTMENT

Reference

Performance Test: None
Service Section: RF Section

Description

In this procedure, the DUT's RF output is connected to an external detector and the detector's output is then connected to the DUT's XTAL LEVELING input and a DVM. The DUT is then set to external module leveling, 0 dBm and 10 dBm. At both levels, the DUT's Cal Constants are adjusted for the correct DVM reading and the correct POWER dBm DISPLAY reading.

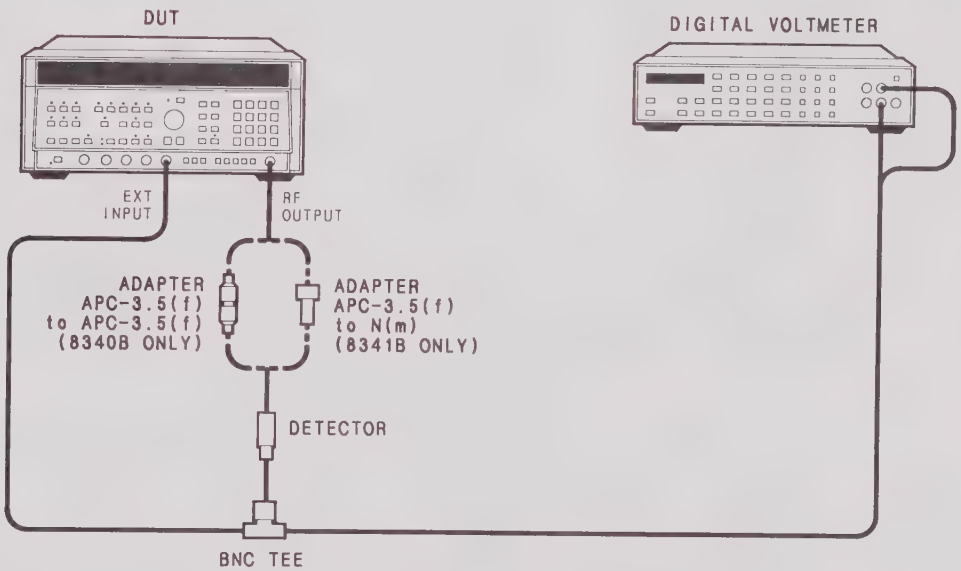


Figure 5-70. External Module Leveling Adjustment Setup

Equipment

Digital Voltmeter (DVM)	HP 3456A
Detector, Positive	HP 8473C Option 003
Adapters:	
APC 3.5 (f) to APC 3.5 (f) (required for HP 8340B only)	HP P/N 5061-5311
APC 3.5 (f) to Type N (m) (required for HP 8341B only)	HP P/N 1250-1744
BNC (f) to Dual Banana	HP P/N 1251-2227
BNC Tee	HP P/N 1250-0781

5-19. EXTERNAL MODULE LEVELING ADJUSTMENT (Cont'd)

Procedure

1. Connect the equipment as shown in Figure 5-70. Turn the DUT's LINE switch ON and allow 30 minutes for the equipment to warm up.

2. On the DUT, press **[INSTR PRESET] [CW] [4] [GHz] [AM] [SHIFT] [XTAL] [0] [dBm]** to turn AM on and to set the DUT to external module power leveling of 0 dBm. Press **[SHIFT] [GHz] [3] [5] [Hz] [SHIFT] [MHz] [1] [2] [Hz] [SHIFT] [kHz] [2] [2] [Hz]** to access Cal Constant 35.

NOTE

If, in step 3, Cal Constant 35 is adjusted for a negative voltage reading on the DVM (i.e., −0.002V), it is possible that the DUT's OVERMOD annunciator will turn on. If this occurs, rotate the DUT's rotary knob to turn the OVERMOD annunciator OFF and then adjust the DVM for the proper voltage reading.

3. Using the DUT's front panel rotary knob, adjust Cal Constant 35 (range is −100 to +100) until the DVM reads 0.000 V ± 2 mV.

4. Using the DUT's **[▲]** step key, access Cal Constant 37. Using the DUT's rotary knob, adjust Cal Constant 37 (range is −100 to +100) until the DUT's POWER dBm display indicates 0.0 dBm.

5. On the DUT, press **[SHIFT] [XTAL] [1] [0] [dBm]** to set the external module power to +10 dBm. Press **[SHIFT] [GHz] [3] [6] [Hz] [SHIFT] [ENTRY OFF]** to access Cal Constant 36.

6. Using the DUT's rotary knob, adjust Cal Constant 36 (range is -100 to +100) until the DVM reads 0.3 V ± 2 mV.

7. Using the DUT's **[▲]** step key, access Cal Constant 38. Using the DUT's rotary knob, adjust Cal Constant 38 (range is −100 to +100) until the DUT's POWER dBm display indicates 10.0 dBm.

8. Repeat steps 2 through 8 to ensure that the adjustments are within tolerance.

9. On the DUT, press **[SHIFT] [MHz] [1] [4] [Hz] [SHIFT] [kHz] [5] [3] [4] [9] [Hz].** Wait for "CALIBRATION STORED" to be displayed in the DUT's ENTRY DISPLAY and then press **[INSTR PRESET].**

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